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THE BROWN'S PARK FORMATION¹

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(PLATES IX-XV)

INTRODUCTORY

In the northwestern corner of the state of Colorado, covered by Moffat County, there is located a Tertiary formation of considerable geographical extent, the geological age of which for many years has been the subject of discussion among geologists. Hayden in his "Preliminary Report of the United States Geological Survey of Wyoming and Portions of Contiguous Territories," 1871, p. 64, states that these sediments are of Pliocene age, while King (U. S. Geol. Sur. 40th Paral., 1877, p. 222) regarded the beds as most nearly allied to the Green River group, to which he referred them.² Sinclair in his paper on the "Volcanic Ash in the Bridger Beds of Wyoming," regards the Bishop (Wyoming) Conglomerate as probably Pleistocene, (Bull. Amer. Mus. Nat. Hist., Vol. XXII, 1906, p. 278).

Until within the past year the age of the Brown's Park Formation has remained uncertain. In a paper published as late as 1924³ Sears quotes Douglass as believing the formation to be probably of Miocene age, and also quotes Peterson as saying that he believed the deposits to be probably of lower Miocene age, although

¹Major J. W. Powell in his report on the Geology of the Uinta Mountains used the name "Brown's Park Formation" (U. S. Geol. and Geogr. Survey of the Terr. 1876, p. 4).

²In other places in King's report he suggests the possibility that these beds may be one of the later Tertiary formations. King was perhaps partly influenced in making these suggestions by Hayden's original statements in his report of 1871.

³Sears, Julian D., Bull. Geol. Soc. of America, Vol. XXXV, 1924, p. 287.

they may belong to the uppermost Oligocene. In 1924⁴ Peterson described some fossil mammalian remains from the Brown's Park beds as of lower Miocene age, but the closing sentence in the introduction to his paper informs the reader that the determination of the age of the Brown's Park sediments should be regarded as provisional, "subject to verification upon the discovery of more complete paleontological evidence." From an abstract of Peterson's paper, forwarded to T. W. Stanton as a personal communication, Stanton in a foot-note to a paper by E. T. Hancock⁵ states that Peterson regards the Brown's Park formation as being probably lower Miocene.

White in the Tenth Annual Report of the United States Geological and Geographical Survey, 1878, p. 38, in speaking of the Brown's Park sediments says: "The relation which this group has to similar groups in different parts of that great western region remains for future investigation to determine, its relation to those [beds] immediately associated with it is a matter of great interest, which will be much enhanced by any paleontological testimony that its strata may yet furnish." In consulting the numerous reports upon the Brown's Park formation, from that of Hayden in 1871 to and including that of Hancock in 1925 (*l. c.* pp. 24-25), it is quite clear that all made a diligent search for fossil remains in the Brown's Park beds with little or no success. During the summer of 1923 Messrs. Douglass and Kay in the employment of the Carnegie Museum discovered near Sunbeam, Colorado, in the Brown's Park sediments the first mammalian remains sufficiently perfect to permit of description.⁶ In 1925-1926 the field party in charge of Mr. J. LeRoy Kay was so fortunate as to secure additional mammalian remains in the Brown's Park sandstones. The purpose of this paper is to give a short review of the geology of the Brown's Park and Bishop Conglomerate beds and to describe this additional material. This is undertaken with a view to assisting geologists in placing the two formations mentioned in their relative sequence in the Tertiary strata of our western states.⁷ Judging from the fauna described in this paper the Brown's Park formation seems to be near the geological age of such Miocene and Pliocene formations as the Pawnee Creek of Colorado, the Madison Valley, probably the Flint Creek and Deep River of Montana; the Santa Fe of New Mexico; the Mascall of Oregon, and the Virgin Valley of Nevada.

⁴Peterson, O. A., *Ann. Car. Mus.*, Vol. XV, 1924, pp. 299-305.

⁵Hancock, E. T., *Bull. 757 U. S. Geol. Surv.* 1925, p. 25.

⁶*Ann. Car. Mus.* Vol. XV, 1924 pp. 299-304. A review of this work will appear in the present publication.

⁷A preliminary note by O. A. Peterson was published in *Science* (N. S.) 63, 1926, p. 231, calling attention to the discovery of a long-jawed proboscidean in the Brown's Park formation, and also stating the view that it represents the Upper Miocene and Lower Pliocene.

The very important role, which the Brown's Park and Bishop Conglomerate formations played in shaping the courses of the Green and Yampa rivers through canyons of the Uinta and Yampa uplifts, is fully recognized as an extremely tempting question for discussion. However, before entering upon this theme a much longer time than I have been able to devote to work in the field is obviously necessary in order to finally pass upon the many previous observations of others. Nevertheless I may in passing say that according to the present state of my knowledge of the geology of the Uinta and Brown's Park basins I am strongly inclined to the view of Emmons,⁸ Hancock,⁸ Sears,⁸ and others that the courses of the Green, the Vermillion, the Snake, and Bear rivers were established on the Bishop Conglomerate and Brown's Park formation as against the hypothesis of J. W. Powell⁹ and others who maintained that these rivers already existed in their present channels before the deposition of the formations which we are studying.

The writer takes pleasure in expressing his gratitude to Mr. William Weller on whose ranch the greater part of the material was found, and who not only extended hospitality, but gave cordial assistance to Mr. J. LeRoy Kay who collected the fossil remains, and materially helped in obtaining the cross-sections, contact sections, and other data. Special thanks are due to Mr. Childs Frick for his financial assistance which enabled me to make my trip to the Brown's Park region during the summer of 1926. I acknowledge the kindness of Professor Henry Fairfield Osborn, who allowed me to use an unpublished illustration for comparison in connection with the description of a Pleistocene elephant from Lay Creek, Moffat County, Colorado; and of Dr. J. D. Figgins, Director of the Colorado Museum of Natural History, Denver, Colorado, for permission to identify and describe a proboscidean molar tooth from western Colorado, the property of the Denver Museum, and of Dr. Charles C. Mook for assistance in the identification of a Pleistocene proboscidean. I am indebted to Director A. Avinoff for helpful suggestions in my work, and for making the restoration shown on Plate XV in this paper, the illustrations of which are chiefly from drawings made by Mr. S. Prentice. I desire to recognize the skill of Mr. S. Agostini who extracted from the matrix and prepared the material from Brown's Park for study and exhibition. Finally I wish to express my indebtedness to Dr. W. J. Holland, who has revised and edited this paper, as in times past he has revised and edited many others for the writer.

⁸U. S. Geol. Expl. 40th Par., vol. 2, 1877 pp. 194, 187; U. S. Geol. Survey Prof. Paper 90, 1915, pp. 183, 189; Bull. Geol. Soc. of America, Vol. 35, 1924 pp. 279-304.

⁹Exploration of the Colorado River of the West and its tributaries. 1875. pp. 152-153.

GEOGRAPHY AND ROUTES OF TRAVEL.

The Brown's Park Formation rests in a long, narrow, irregularly shaped basin, and is bounded by the Uinta Mountains to the southwest, by the Cold Spring Mountains to the northwest, by a low ridge and the Cedar Mountain to the north, by Douglas, Cross, and Juniper Mountains to the south. To the east the formation gradually thins out and is eroded away just before the town of Craig, the present western terminus of the Denver and Salt Lake Railroad ("Moffat Line"), is reached. Four large streams cut through this sedimentary mass: the Green River from the west; Vermillion Creek and Little Snake River from the north; and the Yampa River from the east. All these streams join the Green River before the latter stream reaches the southern flanks of the Uinta and Yampa Mountains. The region in which the fossils were found may be reached by automobile from Craig, Colorado, by way of the small stations Lay, Maybell, and Sunbeam. About two miles to the south of Sunbeam is the first locality in which fossils were found in 1923 by the party from the Carnegie Museum. Some twenty-five or thirty miles west of Sunbeam on Weller's Ranch near Smelter Ranch and Gray Stone Post Office is the locality in which the bulk of our material was collected during the years 1925-26. This locality may be reached by roads from Rock Springs, Wamsutter, or Rawlins, Wyoming, on the Union Pacific Railroad; or from Rifle, Colorado, on the Rio Grande Railroad, or from Vernal, Utah.

GEOLOGY.

(Pl. IX).

All geologists who have studied the Brown's Park sediments have observed their unconformity with underlying formations. To the west, northwest, southwest,

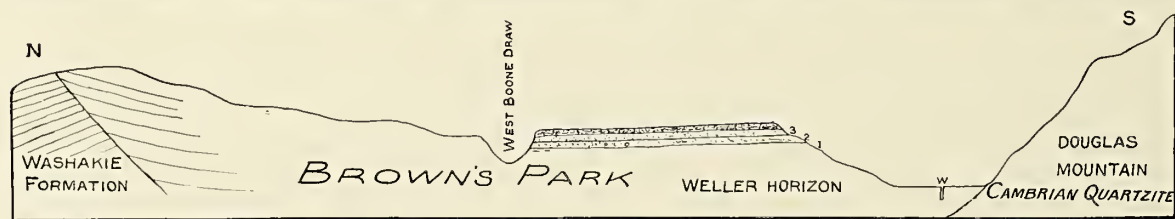


Fig. 1. Cross-section from N. to S. of the Brown's Park sediments at the foot of Douglas Mountain, northward twelve to fifteen miles to the contact with the Washakie formation (Upper Eocene) of the Sandwash Basin. 1, 2, 3, Fossiliferous layers at the top of the Weller horizon. W. Well of water eighty to one hundred feet deep on Weller Ranch.

and south the sedimentary mass rests quite generally on older formations from the Cambrian up to the Mesozoic, which form the flanks of the Cold Spring, the Uinta, the Cross, and the Juniper Mountain uplifts. In places along the southern border,

for example at Danforth Hills, the Brown's Park lies on the upturned edges of the Cretaceous rocks (Mesaverde and Mancos Shales). The eastern and considerable portions of the northern border of the Brown's Park beds form contact with the Cretaceous. Along the northern border where the Brown's Park rests on the "Laramie"¹⁰ the writer found no remains of vertebrates, but found fossil wood in considerable abundance in the latter formation.



Fig. 2. Brown's Park Formation resting on Cretaceous at Danforth Hills, about two miles west of "Bob Hugh's Canyon." At the contact the Brown's Park beds dip to the north about five degrees, gradually changing to horizontal towards the basin. There is no evidence of conglomerate in contact at the base of the Brown's Park Formation in this section.

C. A. White¹¹ recognized the Brown's Park sediments at Cedar Mountain to the north of Craig. Gale, Sears, and Hancock (*ll. cc.*) indicate these same sediments as an outlier of the main body of the Brown's Park formation. Cedar Mountain is completely surrounded by the Brown's Park sands and sandstone and the elevation itself is covered with basalt, which according to Sears "rests upon white sandstone of the Brown's Park formation." Hancock found some of the Brown's Park sandstone resting upon the basalt.¹² According to these investigations the Brown's Park formation and the basalt formation of Cedar Mountain are of the same geological age which is now determined to be upper Miocene. The Cedar Mountain region was not visited by the writer during his recent trip to western Colorado.

The northern border of the Brown's Park sediments for the greater distance from Cold Spring Mountain to the eastern limit, rests unconformably chiefly on Tertiary beds of the Wasatch, the Green River, and the Washakie (*Cf.* Pl. IX). Continuing eastward the northern border is found resting on the Cretaceous, as already stated. Contact sections were obtained between the Brown's Park and

¹⁰Gale, H. S. Bull. 415, U. S. Geol. Survey 1910. Note: On page 69 Gale says that "the Laramie formation overlies the Mesaverde in the Yampa coal-field, intervening between the Mesaverde and the succeeding tertiary formations." Gale again discusses the Laramie on pages 72 & 73 of the same work, Sears (Bull. 751 G, U. S. Geol. Surv., 1924, p. 291) apparently follows Gale in referring this formation to the Laramie in their work in Moffat County, Colorado.

¹¹Ninth Ann. Report U. S. Geol. Survey, 1889, p. 691.

¹²U. S. Geol. Survey, Prof. paper 90, p. 187, 1915.

underlying beds at points visited by our party, which indicate considerable variations of dip in the Brown's Park sediments in different localities. Sears states¹³ that "between the outward-dipping older rocks and the inward-dipping sandstones of the Brown's Park, there is angular unconformity ranging from 10 to 100 degrees."



Fig. 3. Brown's Park Formation resting on Cretaceous, "Post Laramie," northwest of Lay Post Office, Moffat County, Colorado. The dip of the Cretaceous is about 15° and that of the Brown's Park 12°. To the south, or toward the basin, the Brown's Park sediments gradually become horizontal. C. Basal conglomerate of the Brown's Park Formation about seventy feet thick.

In the Brown's Park sediments along the northern border there is a general presence of a basal conglomerate, which varies considerably in vertical depth, and may be of stream-origin. This conglomerate is seldom noticed at contacts to the south. I fully agree with Sears¹⁴ in regarding this basal conglomerate as of the same general age as the Bishop Conglomerate, exposed in many places on either side of the Uinta Mountains, the much greater dip of the Brown's Park strata at its present borders than in the basin proper is due, at least in part, to movements which took place subsequent to the deposition of the Brown's Park beds. Sears says: "as the Brown's Park forms the ridge, and the Eocene beds to the north in Sandwash Basin are at a lower elevation, these escarpments cannot mark the edge of deposition which stopped short of the zone of disturbance. The only possible explanation seems to be that the region to the south was depressed after Brown's Park time, and that the soft Brown's Park beds north of the zone, left at a much higher elevation, have been entirely eroded" (*l. c.* p. 292). The Brown's Park formation must thus be regarded as having formerly covered a territory of great extent, of which now only relatively small remnants are left on either side of the Uinta-Yampa uplifts. White states that "remaining patches of (Uinta sediments) show that the formation formerly extended eastward as far as the foothills of the Park Range."¹⁵

The Brown's Park sediments, outside of the basal conglomerate, are generally composed of soft, almost chalk-white sands and sandstones cemented with lime, sometimes intercalated with slightly argillaceous bands. This is generally the

¹³Bull. Geol. Soc. of America, Vol. 35, 1924, p. 287; Bull. 751, p. 306, U. S. Geol. Survey, 1924.

¹⁴Bull. 751-G, U. S. Geol. Survey, 1924, p. 296.

¹⁵Tenth Ann. Report, U. S. Geol. Surv., 1877, p. 38.

most characteristic feature in the eastern and middle sections of the basin, where the formation weathers into ravines, buttes, and table-lands. The Weller horizon,



Fig. 4. Section shown five miles north of Sunbeam, Moffat County, Colorado. At this point the Brown's Park Formation is found resting on the Cretaceous at an angle of about 34° to the south. There is evidence of cross-bedding, but no basal conglomerate of the Brown's Park sediments was found.

exposed at the northern flanks of the Douglas Mountain, on the Weller ranch near the Gray Stone Post Office, consists of very soft sandstone, which weathers into sandy ridges capped by a layer of harder sandstone from six to fifteen feet thick. This harder sandstone (the Weller Sandstone) presents sufficient resistance to erosive agencies to form broad table-lands, which are usually covered by Pinions



Fig. 5. Type locality of the Weller horizon, at which most of the fossil remains were found on the Weller Ranch. Northern base of Douglas Mountain, looking toward the basin.

and Juniper trees, a characteristic feature throughout the middle section of the Brown's Park basin. A vertical section of about 736 feet, from the Cambrian contact to the top of the Weller sandstone, may be named the Weller horizon. Toward the upper part of this horizon the main bulk of the fossil remains found in Brown's Park by the parties from the Carnegie Museum were obtained. The Weller sandstone is approximately in the middle vertical section of the sedimentary mass of the Brown's Park. The horizon above the sandstone (the Upper Brown's Park)

did not yield fossil remains, although its lithological characters are practically similar to the section below the Weller sandstone. (See fig. 1.)

The western end, or the Green River and Vermillion Creek exposures, often show material of different lithological composition. The color is a light gray, or quite similar to that in the middle and eastern sections, but the wearing down of the formation, especially of this portion along the Vermillion, leaves vertical cliffs of great height. The Brown's Park sediments in this section consist of alternating harder and softer layers of sandstone. The harder layers are heavily charged with lime, often with condensed flint-like or chalcedonous masses of considerable size, or with parts full of cavities ranging from minute size to small caverns, sometimes like geodes. This whole sedimentary mass appears as if it may have had its origin, in part, from numerous warm springs distributed over a large area of the western end of the basin. The deposition from warm springs may account for the local unconformity mentioned in Sears' report (*l. c.* Bull. 751 G. p. 291). Although diligent search for fossil remains was made by the parties from the Carnegie Museum in 1925-26, nothing was found. The shaft of a limb bone was found near Jarvis Ferry on Green River by the writer in 1894, as reported in an earlier publication (*Ann. Car. Mus.*, Vol. XV, 1924 p. 299).

UINTA BASIN

On the southern flanks of the Uinta Mountains there are a series of soft argillaceous sandstones and arenaceous clays, approximately one thousand two hundred to one thousand four hundred feet thick having a reddish yellow color.¹⁶ In an east and west line these sediments extend from Deadman's Bench east, to the vicinity of Strawberry Valley at the western end of the Uinta Basin. Major Powell and other early observers appear to have associated these uppermost beds of the Uinta Basin with the typical Brown's Park formation to the north and east of the Uinta and Yampa uplifts. Among workers in later years Schultz¹⁷ clearly recognizes the Bishop conglomerate and the overlying Tertiary rocks.

From what is generally regarded as the base of horizon C at "Kennedy's Hole" in the eastern borders of that horizon westward to the vicinity of the Ouray Agency on Green River and Myton on the Duchene River the fauna is known through the researches of Marsh, Osborn, Scott, Hatcher, Douglass, and Peterson. In 1894 and

¹⁶U. S. Geol. Surv. Terr., Fourth Ann. Report 1870, p. 57; U. S. Geol. Surv. Terr., "Geology of the Uinta Mountains", 1876, p. 168; U. S. Geol. Surv., Tenth Ann. Report, 1877, pp. 18, 19; Report Exploration 40th Paral., Vol. II, 1877, p. 225.

¹⁷Schultz, Alfred R., U. S. Geol. Surv., Bull. 690-C, 1918, pp. 56, 67, 86 and map of the Phosphate Deposits along the north and south slopes of the Uinta Mountains in Northeast Utah.

succeeding years Peterson¹⁸ while collecting fossils in the Uinta basin found it convenient to divide the Tertiary strata overlaying the Green River formation into three horizons, A, B, and C. The Brown's Park Beds were recognized, but it is now quite evident that this formation, or horizon C, was regarded as extending too far down into the upper Eocene sediments, or into the horizon B of the Uinta. This error was due to the fact that no distinct break between the Eocene and the Brown's Park beds were found by Peterson in 1894. Riggs¹⁹ in 1912 wrote quite complete stratigraphic notes and furnished sections of horizons A and B of the Uinta sediments, but did not take up any discussion of horizon C, because he apparently did not collect any fossils in these clays and fine-grained sandstones. According to field notes Peterson in 1912 continued a search, without success, for a true contact between the Uinta and Brown's Park along the southern borders of the latter formation. At the southern base of the Uinta Mountains Brown's Park rests unconformably on all underlying formations from the Green River Tertiary²⁰ to the Cambrian, while along the southern edge of the formation, due to unusual conditions, Brown's Park rests upon a Uinta or upper Eocene sedimentary surface comparatively undisturbed.

It seems most advisable to retain horizon C in our records, but to restrict the horizon to those clays and sandstones in which *Diplacodon*, *Protitanotherium*, *Eotitanotherium* and most of the microfauna of the Uinta sediments were found by the earlier and later collectors. This horizon would then include the softer sandstones, the fine grained sandstones and clays above horizon B, from Kennedy's Hole in the eastern end of the Uinta basin westward to Chipita Grove on White River, thence westward to the Ouray Agency and up Duchene River to Myton. The ultimate discovery of contact between the proposed horizon C and the true Brown's Park will then govern the vertical thickness of both horizon C and the overlying Brown's Park. It is quite obvious, that, if we accept, as seems logical, the determination by many geologists, including the latest work by Schultz²¹ that the Bishop conglomerate along the southern flanks of the Uinta Mountains underly Tertiary beds we cannot regard these as upper Eocene or lower Oligocene in the Uinta Basin while to the north and east of the mountains these beds, the

¹⁸Peterson, O. A., Bull. Amer. Mus. Nat. Hist., Vol. VII, 1895.

¹⁹Riggs, E. S., Field Mus. Nat. Hist., Pub. 159, Geol. Series, Vol. IV, 1912, pp. 17-25.

²⁰The typical horizons A and B of the Uinta sediments are not exposed below the Brown's Park along the northern border of the latter formation.

²¹Schultz, A. R., See map and pages cited above.

Bishop conglomerate and Brown's Park, are now known to be late Miocene.²² Secondly, by retaining horizon C of the Uinta Eocene we would keep undisturbed our published records of paleontology.

PLEISTOCENE

Occasionally there are thin deposits of Pleistocene age along small stream valleys in the Brown's Park basin. On Lay Creek there is found such a deposit made up of worked over material of the Brown's Park and underlying formations. A molar tooth of a Pleistocene proboscidean was found quite close to the Lay Post Office on Lay Creek which is figured in this report.

THE FAUNA OF THE BROWN'S PARK FORMATION

Class **MAMMALIA**

Order **CARNIVORA**

Family **PROCYONIDÆ**

Genus **BASSARISCOPS** nov.

Type: *Bassariscops willistoni* (Peterson).

Phlaocyon willistoni Peterson. (Cf. Annals Carnegie Museum, Vol. XV, 1924, p. 300). Anterior portion of skull, C. M. Cat. Vert. Fossils, No. 11,332; right ramus of the lower jaws, C. M. Cat. Vert. Fossils, No. 11,333; and the left lower jaw No. 11,334 provisionally referred.

Locality: One mile south and west of Sunbeam, Moffat County, Colorado.

Horizon: Brown's Park Formation, Weller horizon.

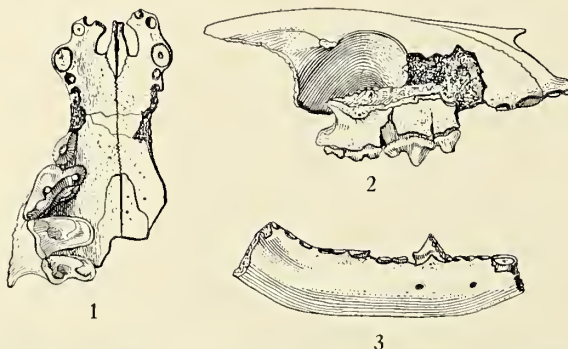


Fig. 6. *Bassariscops willistoni* (Type, C. M. Cat. Vert. Foss. No. 11,332) 1, Palatal view; 2, lateral view; 3, lateral view of lower jaw (C. M. Cat. Vert. Foss. No. 11,333). All figures natural size. (Reproduced from Ann. C. M., XV, p. 301).

²²Very recently there has come to the hands of the writer two specimens just discovered in the Brown's Park of the Uinta Basin which will help us in the determination of the geological age of "horizon C," or the true Brown's Park formation south of the Uinta Mountains. The description of these specimens appears in the sequel.

A very thorough comparison recently made between the types of *Phlaocyon lecosteus* Matthew and *Phlaocyon willistoni* Peterson convinces me that the latter specimen is not referable to *Phlaocyon*. The specimen from the Brown's Park formation, though later in time than *P. lecosteus*, is in some respects less advanced than *P. lecosteus* and apparently more nearly in the line of a *Bassariscus*-like animal. Thus, while the muzzle is broad as in *P. lecosteus*, nasals, infraorbital foramen, canine and the trigon of the carnassial similar; the premolar crowns are more compressed laterally, with greater basal areas in front and back; the shearing blade of the carnassial more distinctly separated from the median, or main cusp.²³ The sectorial tooth is, as originally stated by Peterson, relatively longer than in *Phlaocyon lecosteus*. The molars, especially the second, are also broader than in the genus *Phlaocyon*.

In the original description the specimen from Brown's Park was said to be equal in size to *Bassariscus*. The muzzle is broader than in the latter, but the cheek-teeth, though relatively larger, are quite similar, the antero-internal tubercle of P⁴ of course further forward than in the recent genus from the southwestern United States.²⁴ The new genus stands close to *Phlaocyon*, but, as stated, more nearly in line with *Bassariscus*.

The ramus of the lower jaws, No. 11,333, referred to this species, is of the same size, slenderness, and curvature as that in *Bassariscus*. Unfortunately the teeth are represented for the most part by roots only, but I am able to determine that the

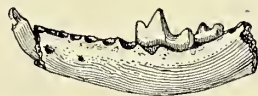


Fig. 7. *Bassariscops willistoni*. External view of lower jaw (C. M. Cat. Vert. Foss., No. 11,334) natural size. (Reproduced from Ann. C. M., XV, p. 303)

canine is large, the crowns of the premolars compressed laterally as in *Bassariscus*, and, though there was a M₃ present, this tooth was undoubtedly quite rudimentary.

²³In my original description, Ann. Car. Mus. Vol. XV, p. 301, I erroneously concluded that the apparent separation of the sectorial tubercle from the protocone is due in great extent to wear.

²⁴Very recently there has come into the hands of the writer a paper by E. Raymond Hall (Univ. of Cal. Press, Vol. 16, No. 11, March 17, 1927) in which he speaks (p. 442) of certain Pleistocene remains of the *Bassariscinae* from the Potter Creek Cave, Shasta County, California. On plate 64, fig. *g*, of this work Hall furnishes a photographic reproduction of the left maxilla with P⁴ and the molars in position. The protocone of P⁴ has the forward position as in *Bassariscops* and *Phlaocyon* described by Matthew and as in the early *Canidae* generally. The postero-internal tubercle on P⁴ of the Potter Creek Cave specimen is apparently larger than in *B. willistoni*; the tooth has a slightly less antero-posterior diameter, and there appears to be a minute tubercle on the basal cingulum opposite the sectorial blade which is absent on the cingulum in the Brown's Park specimen. Altogether it appears that the California specimen may be closely related to the Colorado species and perhaps should not be regarded as a true *Bassariscus*.

The left lower jaw, No. 11,334, referred to this species is of considerably smaller size than the jaw with the type. This specimen was doubtfully referred to *Phlaocyon* by Peterson, *l. c.*, p. 303. At present I am convinced that the difference in size of the two specimens (Nos. 11,333-11,334) under study could easily be individual or sexual. The three specimens (type and paratypes) were found together. The outlines and detailed structure of the ramus, as well as evidence of M_3 in the two specimens, Nos. 11,333 and 11,334, are quite identical. The carnassial tooth of No. 11,334 from the Brown's Park beds, while apparently having the same antero-posterior diameter as that tooth in *Probassariscus antiquus*,²⁵ is slightly narrower, higher, and sharper; M_2 is smaller and the postero-internal angle distinctly less developed. This, together with the absence of a paraconid ridge, which is present in both *Probassariscus antiquus matthei*²⁶ and *P. antiquus*, would seem at least for the present to prevent the association of the specimens from Brown's Park with *Probassariscus*.

Principal Generic Characters Shown by the Type. Broad muzzle; trigon of P^4 triangular as in *Phlaocyon* including the presence of the postero-internal cusp; premolars in front of carnassial compressed more nearly as in the cynoids; sectorial tubercle of P^4 long and separated from the protocone by a deep excavation on the buccal face of the tooth; upper molars relatively broad when compared with *Phlaocyon*. The associated mandibular rami, so far as comparison permits, are closely similar to those of *Bassariscus astuta*. The molars are also quite like those in the recent species, except a smaller and less perfectly developed heel on M_2 and the presence of the rudimentary M_3 .

The relationship between *Bassariscus* and *Bassariscops*, as revealed by the type and material associated with the latter, is most remarkably close. The lower jaws of the fossil and recent forms are identical, so far as one can judge from the available material. The cheek-teeth occupy the same relative area in the jaws of the two except that M_3 is present in the fossil form. In the skull of *Bassariscops*, on the other hand, we have a broad muzzle (presumably also a broad symphysis of the lower jaws) and P^4 with a primitive trigon.

With the recession of the antero-internal tubercle, the slight enlargement of the postero-internal tubercle of P^4 and the reduction of the muzzle we would have, so far as the fragmentary type reveals, a very close relative of *Bassariscus*.²⁷

²⁵Bull. Amer. Mus. Nat. Hist., Vol. XXVI, 1909, p. 377.

²⁶Univ. Cal. Publications, Vol. VI, 1911, p. 246.

²⁷Perhaps even a closer relative to the recent form than *Bassariscus parvus* from the Upper Miocene, Stewart Valley, Nevada, recently named by Hall, Univ. Calif. Publications, Vol. 16, 1927, p. 440.

Order **ARTIODACTYLA**
 Family **OREODONTIDÆ**²³
 Genus **TICHOLEPTUS** (?)

A fragment of a left lower jaw with P_4 and M_1 in position, which has recently come into the hands of the writer, is referred to these American primitive ruminants. The specimen is reported by Mr. Wm. Haslem of Vernal Valley, Utah, to have been found on top of a butte close to the camp of the Emma (Gilsonite) Mine near the bluff of the White River canyon in Utah. If this is the locality at which this specimen was found²⁹ we have perhaps at last located the contact between the true Brown's Park formation and the horizons A, B, and C of the upper Eocene sediments in the Uinta Basin.

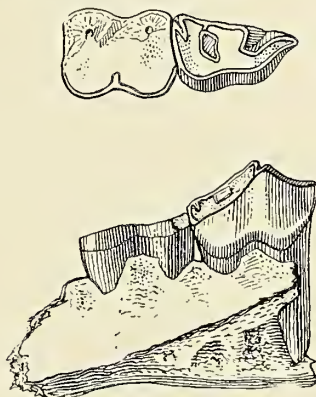


Fig. 8. *Ticholeptus*?; fragment of mandible with premolar in place (C. M. Cat. Vert. Foss., No. 11,391) natural size.

In size the specimen referred to compares with the larger species of *Ticholeptus* (*T. breviceps* Douglass and *T. petersoni* Loomis), but may perhaps be from a later geologic horizon than either. The detailed structure of P_4 in the specimen from the Uinta Brown's Park is almost identical with that in *Ticholeptus breviceps*. The latter species has, however, a well marked basal cingulum, which is entirely wanting in the specimen from Utah. The excavation of the external face of P_4 , which gives a laterally constricted appearance to the mid-anteroposterior region of the crown in *T. breviceps*, is very much less pronounced in the specimen from Utah. Altogether the latter specimen appears possibly to be of a later geologic age than the species from Montana. M_1 is much worn and displays the usual features found in well worn teeth of the oreodonts. The specimen has been presented to the Carnegie Museum and bears Catalog No. 11,391.

²³Leidy, Extinct Mammalia of Dakota and Nebraska, Journal Acad. Nat. Sci. Phila., Vol. VII, 1869, p. 71.

²⁹There does not now seem to be any reason for doubt as to the accuracy of Mr. Haslem's report.

Family TYLOPODA.

Genera? Species?

(Plate X. figs. 3, 4).

In the Weller horizon of the Brown's Park sediments were found the distal end of the humerus and the greater portion of the radius and ulna of a Cameloid about the size of *Oxydactylus longirostris* from the Miocene of western Nebraska.³⁰ Perhaps the most noteworthy feature in what is left of the humerus is the very feeble development, or rather absence, of the crista on the capitellum of the distal articulation of the bone. In *Oxydactylus longirostris* the crista, or intertrochlear ridge on the capitellum, is distinctly more developed than in the type of the genus, *O. longipes*. A second feature of the specimen under description is the perforation of the bony septum at the bottom of the olecranon fossa, through which protrudes the point of the process on the lower edge of the olecranon of the ulna on extreme flexion of the elbow joint. It is quite evident that the camel represented by the specimen here described cannot be placed with the genus *Oxydactylus* and is provisionally regarded as a cameloid of a later geological horizon.

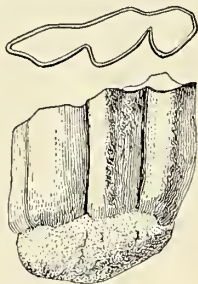


Fig. 9. Cameloid allied to *Stenomylus*; M₃ of right side (C. M. Cat. Vert. Foss., No. 11,336) natural size. (Reproduced from Ann. C. M. XV, p. 304)

A smaller cameloid is represented by the tibial half of an astragalus and a fragment of a phalanx. In size the animal to which these parts belong was between *Oxydactylus longiceps* and *Stenomylus gracilis*, but nearer the latter. Both the astragalus and phalanx are typical of the Miocene Tylopoda. To this is also doubtfully referred a fragment of a tympanic bulla. The molar tooth (See fig. 9) described and figured in an earlier paper may also be provisionally placed here.³¹

SUBORDER BOOIDEA

Family MERYCODONTIDÆ Matthew.

Genus MERYCODUS? sp.?

In extracting the remains of *Serridentinus fricki* (See *infra*) from the matrix

³⁰Ann. Car. Mus. Vol. VII, 1911, p. 260.

³¹Ann. Car. Mus. Vol. XV, 1924, p. 304.

there were found commingled with these remains the greater portion of a scapula and fragments of the phalanges of a *Cervid* (C. M. Cat. Vert. Foss., No. 11,385), which compare fairly well with these parts of *Merycodus* from the Middle Miocene of other localities. No generic or specific determination can be made.

Order **PERISSODACTYLA**

Family **RHINOCEROTIDÆ**

Genus **APHALOPS**

Aphalops ceratorhinus Douglass³²

(Plate X, fig. 1, 2, and 5)

Vertebræ, ribs, limb-bones, and the greater part of the left foot of one individual of a large rhinoceros were found in the upper part of the Weller horizon of the Brown's Park formation. The calcaneum of the type (of which Douglass gives the fibular view in his paper of 1908) is identical in size and general structure, with that bone in the hind foot from Brown's Park. After a critical comparative examination, so far as the material permits, there is little or no hesitation on the part of the writer in referring the remains from Brown's Park to *Aphalops ceratorhinus*.

For the purpose of a better appreciation of the anatomical differences between the well known *Teleoceras fossiger* and the little known *Aphalops ceratorhinus* a comparative description will here be given. On plates IV and V in the Bulletin of the American Museum of Natural History, Vol. XXXVIII, Dr. W. D. Matthew illustrates the fore and hind feet of *Aphalops ceratorhinus* (No. 9745, A. M. N. H. Catalog), from the Madison Valley beds of Montana. Matthew regards this specimen as a topotype of the species, but furnishes no detailed description of the specimen, except very briefly on p. 206 of the same publication.

THE VERTEBRAL COLUMN

The vertebral column is represented by the last dorsal, three lumbar, and two posterior centra of the sacrum. Centra of the posterior dorsals and the lumbar are in general construction similar to those in *Teleoceras*, but the neural spines relatively greater in their antero-posterior diameters. The summit of the third lumbar vertebra is much reduced in its antero-posterior diameter, when compared with those in front of it. The centra of the sacrum are distinctly more delicate in their proportion than the corresponding parts in *Teleoceras*.

³²Douglass, Earl, Ann. Car. Mus., Vol. II, 1903, p. 195; *ibid.* Vol. IV, 1908, p. 260.

RIBS

The ribs are represented by numerous fragments from different parts of the thorax. Shafts of the third (?) fourth (?) and a great number of the posterior ribs are among the best parts preserved. The shafts of the first ribs appear to be slenderer than in *Teleoceras*. In fact all the ribs, judging from the material in hand, are lighter in construction than in the latter genus, and no doubt the thoracic cavity was smaller in *Aphalops ceratorhinus*.

MEASUREMENTS

Last dorsal and three lumbar vertebra: total length of series.....	300 mm.
Last dorsal vertebra: length of centrum.....	83 mm.
Last dorsal vertebra: height of spine.....	103 mm.
Last dorsal vertebra: antero-posterior diameter of neural spine, near top.....	73 mm.
First lumbar vertebra: length of centrum, approximate.....	74 mm.
First lumbar vertebra: antero-posterior diameter of neural spine, near top.....	74 mm.
Second lumbar vertebra: length of centrum approximate.....	80 mm.
Second lumbar vertebra: antero-posterior diameter of neural spine, near top.....	74 mm.
Third lumbar vertebra: length of centrum, approximate.....	77 mm.

FORE LIMB

(Plate X, fig. 2)

The scapula of *A. ceratorhinus* is long, narrow, and rather delicately formed, when compared with the same bone in *Teleoceras fossiger*. The spine and subscapular border rise more gently from the glenoid cavity upward and the coracoid is decidedly less developed than in *A. fossiger*. In the specimen from Brown's Park the suprascapular border is slightly injured, but enough is preserved to determine that this border is more nearly rounded and does not terminate above in the prominent tubercle characteristic of *Teleoceras fossiger*. The spine overhangs the subscapular surface in a similar manner as in *A. fossiger*, but it terminates in a much less developed tubercle than in the latter species. The glenoid cavity is entirely wanting in the specimen under description.

MEASUREMENTS

Scapula, from coracoid border to suprascapular border.....	500 mm.
Scapula, greatest antero-posterior diameter of blade.....	200 mm.
Scapula, antero-posterior diameter of scapula just above glenoid cavity.....	115 mm.

FORE FOOT

In the specimen under description Mc.II is slenderer than in *A. fossiger*. This is especially noticeable when the proximal and distal ends of these bones in the two

species are compared. In *A. fossiger* the diameter, especially of the proximal end, is as great as, or greater than, in *A. ceratorhinus*, while the length of the bone is over thirty millimeters shorter than in the latter. The shaft of Mc.II in *A. fossiger* is accordingly seen to be much constricted when compared with the same bone in the specimen being described. While the dorsal face of Mc.II is similar in the two species compared, the palmar surfaces differ. In *A. ceratorhinus* there is a median keel-like ridge, especially well developed halfway between the proximal and distal ends. This ridge divides in equal proportions the internal and external parts of the shaft, while in *Teleoceras fossiger* the median ridge is absent, and instead there is a heavy osseous development along the entire length of the shaft near the radial border. External to this ridge, especially in fully adult and old individuals of *T. fossiger*, there is developed a deep fossa taking up the greater area of the palmar face, while in *A. ceratorhinus* the palmar face of Mc.II has a fossa on either side of the median keel. In the latter species there are deep pits on either side of the shaft near the distal articulation; the pit externally is especially large and deep. In *T. fossiger* these pits for muscular attachments are quite generally absent; when present, they are much less developed. There are no noteworthy differences in the distal and proximal articulations of Mc.II in the two genera.

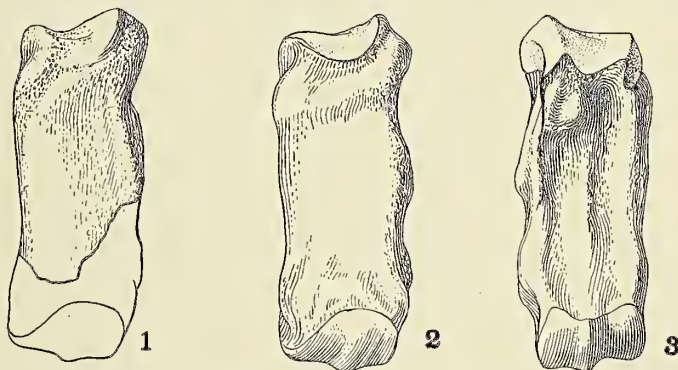


Fig. 10. *Aphalops ceratorhinus* Douglass. 1, Dorsal view of Mc.II, type specimen (C. M. Cat. Vert. Foss., No. 857); 2, *A. ceratorhinus*. Dorsal view of Mc.II, (C. M. Cat. Vert. Foss., No. 11,387); 3. Palmar view of Mc.II, (C. M. Cat. Vert. Foss. No. 11,387). All figures one-third natural size.

The proximal end and a considerable portion of the shaft of Mc. II is present in the type of *A. ceratorhinus*. These parts agree quite well with the characters in the specimen from the Brown's Park beds just described.

The proximal phalanx of the second digit is short and heavy and in a general way similar to that in *Teleoceras*. The ungual phalanges, which we possess, are longer and not so broad as in the latter genus.

MEASUREMENTS

Mc. II: greatest length.....	138 mm.
Mc. II: greatest transverse diameter of head.....	54 mm.
Mc. II: greatest antero-posterior diameter of head.....	36 mm.
Mc. II: greatest transverse diameter of shaft.....	53 mm.
Mc. II: greatest transverse diameter of distal trochlea.....	44 mm.
Mc. II: greatest antero-posterior diameter of distal trochlea.....	39 mm.

HIND LIMB

The pelvis is represented by fragments of the ilia. This part of the hind limb appears to be a broad flaring gluteal surface and a short posterior shaft, perhaps not unlike that of *Teleoceras*.

FEMUR

(Pl. X, figs. 1 and 5)

The femur of *Aphalops ceratorhinus* is at once distinguished from that of *Teleoceras fossiger* by the extraordinary development of the lesser trochanter. The bone is flattened by crushing, which somewhat exaggerates the size of the lesser trochanter, but, allowing for the crushing, the tubercle is of extra large size and otherwise quite like that in *Rhinoceros bicornis*. The articulating head sits low on the proximal end and the superior portion of the great trochanter is on nearly an even transverse line with the articulating head, in part perhaps due to crushing, while in *T. fossiger* the trochanter is placed lower. The third trochanter agrees more in its proportion with that in *T. fossiger*. The shaft is slenderer than that of *T. fossiger*. The tuberosities for the internal and external lateral ligaments are more prominent than in *T. fossiger*. The borders of the rotular trochlea are nearly equally developed, while in *T. fossiger* the internal trochlea is much the larger. The subequalness of the internal and external borders of the rotular trochlea in the specimen under study is no doubt due in part to crushing, but, as in the case of the lesser trochanter just described, when due allowance is made for distortion, the internal border is unusually small for a rhinoceros, and more in line with the titanotheres and *Moropus*.

TIBIA AND FIBULA

With the exception of a few fragments of the distal end, the tibia and fibula are broken up into fragments too minute for detailed study. The posterior portion of the facet for the astragalus displays no noteworthy differences from the corresponding part in *Teleoceras*, while the distal end of the fibula is more delicate in construction than in the latter genus, and compares better with such forms as *Diceratherium*.

MEASUREMENTS

Femur: Greatest length.....	546 mm.
Femur: Transverse diameter at proximal end.....	230 mm. ³³
Femur: Transverse diameter at tuberosity for lateral ligament.....	170 mm. ³³
Femur: Transverse diameter at articulation with the tibia.....	142 mm. ³³

ASTRAGALUS

The trochlea for the reception of the tibia is deeper in the astragalus of *A. ceratorhinus* than in *T. fossiger*. Distally the articulation for the navicular is more

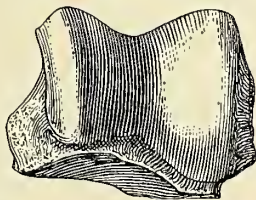


Fig. 11. *Aphalops ceratorhinus* Douglass. Dorsal view of astragalus, (C. M. Cat. Vert. Foss., No. 11,387) one-third natural size.

oblique and convex and the articulation for the cuboid is smaller than in *Teleoceras fossiger*. The facets for the calcaneum are perfectly convex and concave as in *Rhinoceros bicornis* and thus form a more perfect interlocking joint than in *Teleoceras fossiger*. With the exception of a longer neck between the distal and proximal articulations of the astragalus in the Black Rhinoceros this bone in the latter and the fossil form under description are very similar.

CALCANEUM

The most conspicuous differences in the calcanea of *Aphalops ceratorhinus* and

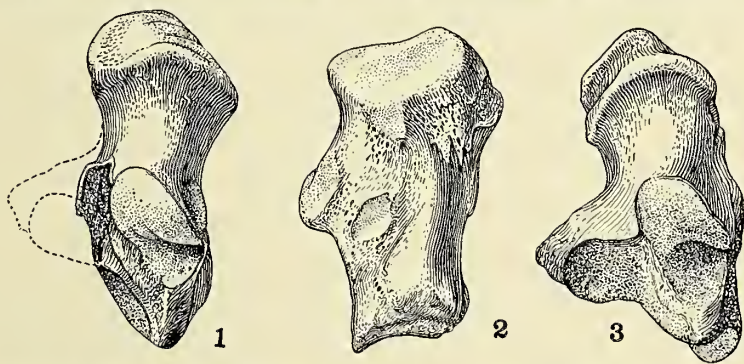


Fig. 12. *Aphalops ceratorhinus* Douglass. 1 and 2, Dorsal and plantar views of calcaneum (type) (C. M. Cat. Vert. Foss., No. 857); 3. Dorsal view of calcaneum (C. M. Cat. Vert. Foss., No. 11,387). All figures one-third natural size.

Teleoceras fossiger are the relatively longer *tuber calcis* and broader articulation for the astragalus in *Teleoceras*. The facets for the astragalus correspond perfectly to those on the astragalus just described. The short and heavy *tuber calcis* and

³³Measurement not reliable due to crushing of the bone.

many other features in the calcaneum of the recent species from Africa are similar to those in *Aphalops ceratorhinus*, but in the recent form the articulating trochlea for the tibia is continued from the astragalus back upon the calcaneum to form a small facet at the base of the tuber calcis and distally the greater and lesser processes are separated by a deep tendinal groove not observed in the fossil.

CUBOID

Great dissimilarity in the cuboid of *A. ceratorhinus* and *T. fossiger* is found in the shape and position of the plantar process. In the latter species the plantar

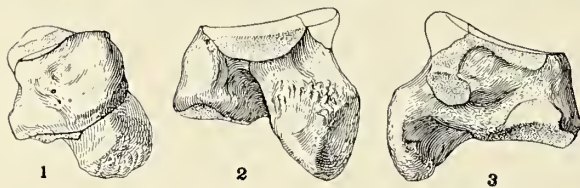


Fig. 13. *Aphalops ceratorhinus* Douglass. Cuboid (C. M. Cat. Vert. Foss., No. 11,387) one-third natural size. 1, Dorsal view; 2, Tibial view; 3, Fibular view.

process is as large as that of the articulating body of the bone in front of the process; the process is cubical in shape and directed horizontally backward from the main body. In *A. ceratorhinus*, on the other hand, the plantar process is much the smaller portion of the cuboid; it has the usual hook-shaped form met with in the Rhinocerotidæ, thus extending well below the distal articulating surface for Mt. IV, and the bone as a whole has relatively great vertical diameter. Among other noteworthy differences of the cuboid in the two genera, which are being compared, mention may be made of the comparatively downward slanting facet for the calcaneum, which forms a blunt wedge on the tibial face of the cuboid in *Teleoceras*, while in *Aphalops ceratorhinus* the tibial and fibular faces of the bone have practically equal vertical diameters.

NAVICULAR

The navicular of *A. ceratorhinus* is relatively long and narrow, when compared with that of *Teleoceras fossiger*. As a result of this difference the articulation for

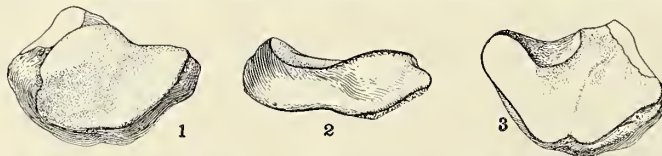


Fig. 14. *Aphalops ceratorhinus* Douglass. Navicular (C. M. Cat. Vert. Foss., No. 11,387) one-third natural size. 1, Proximal view; 2, Dorsal view; 3, Distal view.

the astragalus in the latter genus is simply concave fore-and-aft and slightly convex from side to side, while in *A. ceratorhinus* this articulating surface, besides the con-

cave antero-posterior and convex transverse condition, is oblique or twisted from the dorsal fibular angle to the plantar tibial extremity. The articulation for the cuneiforms differs in the two genera. In *T. fossiger* the triangular-shaped surface for the ectocuneiform is constricted from the oval-shaped surface for the mesocuneiform by excavations in front and back. In *A. ceratorhinus* the two articulating surfaces referred to are not separated, or constricted by anterior or posterior excavations, but the articulation for the ectocuneiform has a much greater invagination from the fibular surface of the bone than is the case in *Teleoceras*. In the latter the facet for the entocuneiform is quite minute and confined to the plantar-tibial angle, while in *A. ceratorhinus* this surface is large and like that for the ecto- and mesocuneiforms, it is located more directly on the distal face of the navicular.

ECTOCUNEIFORM

The more important differences in the ectocuneiform of *Aphalops* and *Teleoceras* are: the greater backward extension of the facets for Mt. II and Mt. III, and the

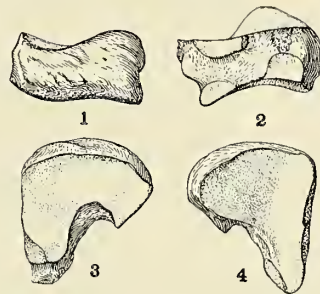


Fig. 15. *Aphalops ceratorhinus* Douglass. Ectocuneiform (C. M. Cat. Vert. Foss., No. 11,387) one-third natural size. 1, Dorsal view; 2, Fibular view; 3, Distal view; 4, Proximal view.

interrupted condition and the position of the facets for Mt. II in *A. ceratorhinus*. In *T. fossiger* the facet for the second digit is continuous from the dorsal to the plantar faces and is at a lesser angle from the facet for Mt. III; while in *A. ceratorhinus* this surface is divided into two facets, located more nearly on the tibial face of the bone.

MESOCUNEIFORM

The mesocuneiform in the two genera, which are being compared, differ chiefly in the greater width and relative shortness of that bone in *Teleoceras fossiger*.

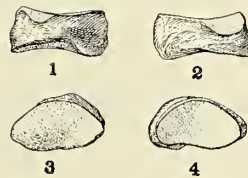


Fig. 16. *Aphalops ceratorhinus* Douglass. Mesocuneiform (C. M. Cat. Vert. Foss., No. 11,387) one-third natural size. 1, Fibular view; 2, Tibial view; 3, Distal view; 4, Proximal view.

ENTOCUNEIFORM

Next to the calcaneum and cuboid the entocuneiform in the two fossil genera, which are being studied, differs more than any other bone in the pes. In *A. ceratorhinus*



Fig. 17. *Aphalops ceratorhinus* Douglass. Entocuneiform, (C. M. Cat. Vert. Foss., No. 11,387) one-third natural size. Tibial view.

rhinus the entocuneiform is of the usual rhinocerotie type, *i. e.* relatively large in size, with great vertical diameter, and with perfectly formed proximal and lateral facets for the articulation of the navicular, mesocuneiform, and Mt.II. In *Teleoceras fossiger*, on the other hand, the bone is reduced, especially in its vertical diameter, and the facet for Mt.II is lost.

METATARSALS

The chief difference in the metatarsals in the two fossil genera above compared is the relative broadness and shortness of the metatarsals in *Teleoceras fossiger*.

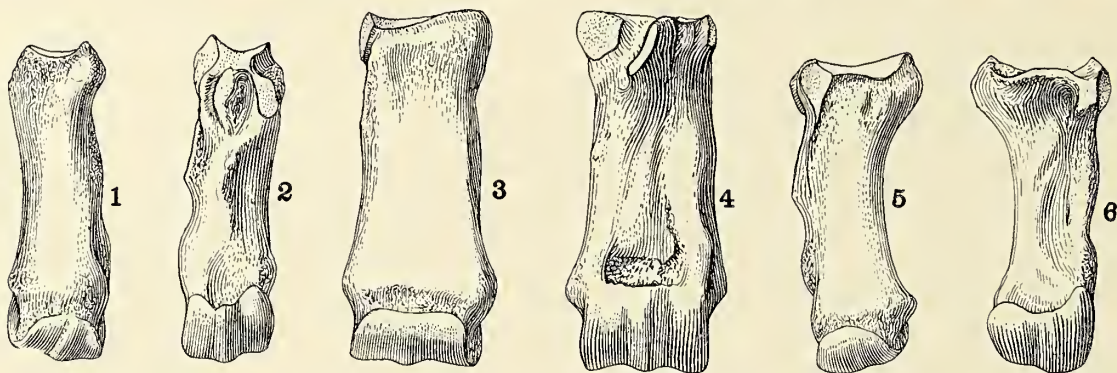


Fig. 18. *Aphalops ceratorhinus* Douglass. 1 and 2, dorsal and plantar views of Mt. II, (C. M. Cat. Vert. Foss., No. 11,387); 3 and 4, Dorsal and plantar views of Mt. III; 5 and 6, dorsal and plantar views of Mt. IV. All figures one-third natural size.

Of perhaps lesser importance is the articular face for the entocuneiform on the tibial face of Mt. II in *A. ceratorhinus*, which is absent in *Teleoceras fossiger*; the subtriangular outline of the articulating face for the mesocuneiform in the latter species; and the lunate outline in *A. ceratorhinus*. The carina on the distal articulation of the metapodials in *A. ceratorhinus* is distinctly more developed than is the

case in *Teleoceras*. This, together with many of the features of *A. ceratorhinus*, which have been above noted, are apparently those of an animal, which lived under conditions not unlike those surrounding the rhinoceroses of today. *Teleoceras fossiger* on the other hand, with its enormous thoracic cavity, its short legs, and the rather simple articular facets of the foot, was, no doubt, an animal rather slow and limited in its movements on land.

MEASUREMENTS

Astragalus: greatest antero-posterior diameter.....	75 mm.
Astragalus: greatest transverse diameter.....	95 mm.
Calcaneum: greatest length.....	118 mm.
Calcaneum: greatest transverse diameter at sustentacular facet.....	80 mm.
Cuboid: vertical diameter at dorsal face.....	35 mm.
Cuboid: transverse diameter at dorsal face.....	44 mm.
Cuboid: vertical diameter at plantar face including plantar tuberosity.....	64 mm.
Navicular: vertical diameter at mid-dorsal region.....	21 mm.
Navicular: greatest transverse diameter.....	70 mm.
Navicular: greatest antero-posterior diameter.....	48 mm.
Ectocuneiform: greatest antero-posterior diameter.....	56 mm.
Ectocuneiform: greatest transverse diameter.....	45 mm.
Ectocuneiform: vertical diameter at mid-dorsal region.....	21 mm.
Mesocuneiform: vertical diameter at dorsal face.....	16 mm.
Mesocuneiform: transverse diameter.....	20 mm.
Mesocuneiform: antero-posterior diameter.....	36 mm.
Ectocuneiform: greatest vertical diameter.....	62 mm.
Mt: II: greatest length.....	122 mm.
Mt: III: greatest length.....	138 mm.
Mt: IV: greatest length.....	121 mm.

PHALANGES

The phalanges of *A. ceratorhinus* are represented by a single proximal and two terminals. The proximal phalanx of the second digit is relatively shorter than is

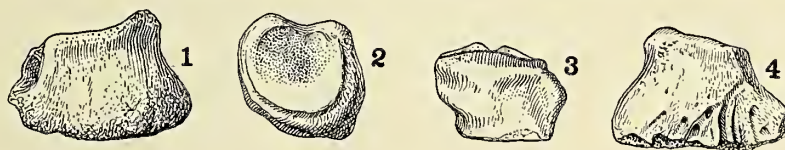


Fig. 19. *Aphalops ceratorhinus* Douglass. 1 and 4, dorsal views of terminal phalanges (C. M. Cat. Vert Foss., No. 11,387); 2 and 3, proximal and dorsal views of proximal phalanx of second digit (C. M. Cat. Vert. Foss., No. 11,387). All figures one-third natural size.

the case in *Teleoceras*. The terminal phalanges on the second and fifth digits are heavy, as in *Teleoceras*, but not nearly so broad.

Family CHALICOTHEROIDEA

Late in the season of 1926 Mr. LeRoy Kay discovered, near the northern edge of the Brown's Park Formation in the Uinta Basin, Utah, a series of crowns of lower teeth which are referable to the aberrant perissodactyls, the Chalicotheres. This specimen, (C. M. Cat. Vert. Foss., No. 11,392) was discovered approximately in the middle of the vertical section of the sedimentary mass referred to the Brown's Park Formation. The specimen is of unusual interest, because it is among the first recorded specimens from the true Brown's Park Formation south of the Uinta Mountains, and greatly assists in the determination of the geological age of this sedimentary mass.

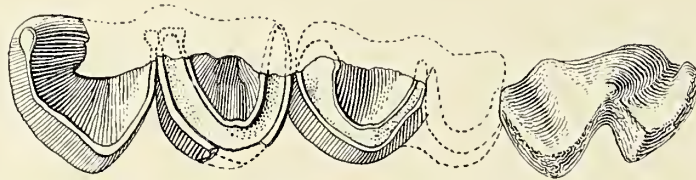


Fig. 20. *Chalicotheroid* Crown view of unerupted P₄, molars one and two of right lower jaw (C. M. Cat. Vert. Foss., No. 11,392). Natural size.

As stated, the specimen consists of the crowns of an unerupted P₄, the posterior crescent of M₁, M₂, and fragments indicating upper teeth of a *Moropus*-like animal. In comparing these teeth with *Moropus elatus* from the Miocene of Nebraska the portion of the tooth P₄, where the anterior and posterior crescents meet, is not nearly as high as in the Nebraskan species. The anterior crescent is more completely filled out, and does not slant nearly so much from before backward, as in *M. elatus*. The first and second molars are badly preserved, but enough is present to determine their moropoid features. Externally the crescents of M₁ and M₂ are fairly well preserved, while internally the crowns were partly weathered away when the specimen was found. In this Uinta form I judge that the crescents of unworn teeth may be filled out to a greater degree, being broader across, than in the Miocene species from Nebraska. It is also of considerably smaller size than the latter. Otherwise there does not seem to be any noteworthy differences between the eastern and western forms, so far as the material permits of comparison.

Order PROBOSCIDEA

An extraordinary number of genera and species of fossil Proboscidea have been described since the publication of the *Fauna Antiqua Sivalensis*, by Falconer and Cautley (1846). When we shall more completely know the different species, many of which have been founded upon fragmentary types, we probably shall reach a

more satisfactory adjustment of the taxonomy than at present prevails. In the meanwhile it is important to describe and illustrate additional material, especially such as is so complete as that recently discovered by the Carnegie Museum in the Brown's Park beds.

Without attempting to enter upon the discussion of the classification of the fossil Proboscidea, which appears to be in a more or less chaotic state, and in which strongly opposite opinions are maintained by certain authorities as to the validity, or non-validity of some generic names,³⁴ I have resolved to provisionally refer the specimen hereinafter described to the genus *Serridentinus* erected by Professor Henry Fairfield Osborn, which is the type of the subfamily *Serradentinae*,³⁵ placed by him in the family *Bunomastodontidae* with the *Longirostrinae* and other subfamilies which have been defined.

GENUS *SERRIDENTINUS* Osborn.

*Serridentinus fricki*³⁶ sp. nov.

(Plates XI-XV)

Type: Greater portion of skull and lower jaws found interlocked in normal position; fragments of vertebræ; ribs and limb bones of an adult, but not old, individual, No. 11,379, C. M. Cat. Vert. Foss.

Horizon: Brown's Park Formation, Weller horizon,³⁷ Middle to Upper Miocene.

Locality: Northern flanks of Douglas Mountain on the Weller Ranch, Moffat County, Colorado.

Principal Characters: Symphysis of lower jaws relatively long, closely approaching condition shown in "*Trilophodon*" *giganteum*.³⁸ Lower incisors rounded, slightly converging toward the apices as in "*Trilophodon*" *osborni* and somewhat suggesting the condition found in "*T.*" *giganteum*.³⁹ Upper tusks relatively long, laterally compressed, slender, with comparatively narrow and light enamel band. Occipital

³⁴Dr. O. P. Hay (Pan-American Geologist, Vol. XXXIX, 1923, p. 111) states that *Trilophodon* has no standing as a generic name. He also regards *Tetralophodon* as a synonym of *Gomphotherium* and raises *Anancus* Aymard to full generic rank, though it was sunk as a synonym by Lydekker (Cat. Foss. Mamm. in B.M. IV, 1886, p. 52). Osborn and Frick appear to retain the name *Trilophodon*, the latter using it with *Serridentinus* in parentheses.

³⁵*Cf. Evolution, Phylogeny, and Classification of the Mastodontoidea*, Bull. Geol. Soc. Amer., Vol. XXXII, 1921, pp. 327-332.

³⁶Dedicated to Mr. Childs Frick in recognition of his great interest in vertebrate paleontology.

³⁷Horizon named after Wm. Weller whose ranch is located on the horizon, where the type specimen was found.

³⁸Amer. Mus. Novitates, No. 1, Jan. 31, 1921, Fig. 4, c. Outline view of lower jaws of *T. giganteum*.

³⁹In using the illustrations in papers cited it is presumed that the specimens are correctly delineated.

plate of skull well rounded from side to side. Second and third molars fully developed.

Serridentinus fricki is provisionally placed between *Trilophodon* ("Tetralophodon") *osborni* Barbour⁴⁰ and *Trilophodon* (*Serridentinus*) *pojoaquensis* Frick,⁴¹ perhaps closer to "*T.*" *osborni*. The species from Brown's Park is separated from *S. pojoaquensis* Frick by its longer and slenderer tusks, narrower and lighter enamel band, and the more anterior location of the infraorbital foramen. Furthermore, the paratype of Frick's species (Skull No. 21,125 A. M. N. H.) has a shorter and higher cranium, the occipital plate almost square transversely, from side to side with very little forward rounding at the base of the zygomatic arches, while this region in our species is much more rounded.

While there are general similarities between the skull of *S. fricki* and the illustrations of "*T.*" *osborni* Barbour, there are, however, differences in details of considerable importance. In the lower jaw, according to Barbour's illustrations and text, the vertical ramus of the larger individual from Nebraska described by him is relatively longer. The symphysis is actually shorter than in the specimen from western Colorado here described. From Barbour's measurements I also conclude that his species has a relatively thicker jaw.

In comparing the illustrations and measurements of the skull, which Professor Barbour associates with the lower jaws of "*Trilophodon*" *osborni* Barbour, the differences between "*T.*" *osborni* of Barbour and *S. fricki*, appear even greater. The total length of the skull of Barbour's type is actually less than that in our specimen, while the lower jaws are relatively longer and thicker as noted. The tusks of the Nebraskan species are short and heavy as in Frick's species *T. pojoaquensis*. On the other hand the tusks in the specimen from Western Colorado are long and rather slender. The relative measurements of the Coloradan and Nebraskan species are all rather discordant. If the skull and lower jaws of "*Trilophodon*" *osborni* Barbour are correctly associated, they bring to light a remarkable condition. The upper tusks, though well formed and strong, do not reach to the front of the symphysis of the lower jaws and apparently never did reach the anterior part of the incisors to protect them in any way, or assist in their function: in fact the illustration by Professor Barbour indicates the upper tusks to be of seemingly little or no use, as Barbour himself states. This is truly a most curious anomaly not usually encountered in morphological studies.

⁴⁰Amer. Jour. Sci., Vol. XLI, 1916, p. 522, four text-figures. Neb. Geol. Surv., Vol. IV. 1917, p. 499-512, twelve text-figures.

⁴¹Bull. Amer. Mus. Nat. Hist., Vol. LVI, 1926, p. 142, figs. 1, 22a, 26, 27, and other figures of referred material.

As has been stated, the skull and lower jaws of the specimen from the Brown's Park sediments were found perfectly articulated. In this species it is clear that the upper tusks touched the lower when the jaws were in motion and thus the tusks, upper and lower, functioned in a perfectly normal manner. The apex of the upper tusk is sharpened from inner and outer wear. This wear is towards the enamel band in such a way as to give the latter a lance-shaped outline (See Pl. XII). The enamel band is 50 mm. wide at the alveolar border and decreases almost imperceptibly towards the apex where it is abraded. The first and second upper cheek-teeth are worn, but it is quite clear that they each had three cross-crests.⁴² The last upper molar is very little worn and is in fine condition for detailed study, (See Pl. XIV, figs. 6 and 7).

The lower tusks are in general shape and proportion, quite similar to those in "*Trilophodon*" *osborni*, as described and illustrated by Professor Barbour. In the lower jaw there are only two molars on either side, which apparently agree in most details with those of "*T.*" *osborni*. The first cheek-teeth are well worn, but plainly show the three cross-crests. In the present species there are two posterior tubercles, or what may be considered as a heavy cingulum, which do not appear to be present on the corresponding tooth in "*T.*" *osborni* as illustrated by Barbour (*l. c.* p. 505, fig. 7). The last molar has three cross-crests and a large heel. The latter may be regarded as a cross-crest. The posterior cingulum consists of a low mammilated ridge, which rises at the postero-external angle of the crown, forming two accessory cones as shown on Pl. XIV, fig. 8 and 9. In Barbour's illustration of the last lower molar (*l. c.* fig. 7) there is indicated a mammilated cingulum on the antero-external angle, which is not present in our specimen.

MEASUREMENTS

Skull, greatest length including incisor.....	1555 mm.
Skull, occiput to incisor alveolar border.....	950 mm. ⁴³
Skull, occiput to infraorbital foramen.....	600 mm.
Skull, occipital condyle to and including first cheek-tooth.....	815 mm.
Skull, occipital condyle to last molar.....	475 mm.
Skull, transverse diameter at posterior portion of zygomatic arch.....	680 mm. ⁴³
Skull, total length of upper cheek-teeth.....	350 mm.
Skull, antero-posterior diameter of first cheek-tooth.....	84 mm.
Skull, greatest transverse diameter of first cheek-tooth.....	64 mm.
Skull, antero-posterior diameter of second cheek-tooth.....	117 mm.
Skull, greatest transverse diameter of second cheek-tooth.....	75 mm.
Skull, antero-posterior diameter of last cheek-tooth.....	162 mm.

⁴²The anterior upper cheek-teeth had fallen out, but were found close to their relative positions. the one in the right jaw fits perfectly in the partly preserved alveolus.

⁴³Indicates measurements in part estimated.

Skull, greatest transverse diameter of last cheek-tooth.....	82 mm.
Lower jaw, greatest length including incisor.....	1292 mm.
Lower jaw, from articulating condyle to posterior edge of symphysis.....	734 mm.
Lower jaw, posterior border of symphysis to and including incisors.....	620 mm.
Lower jaw, articulating condyle to and including first cheek-tooth.....	610 mm.
Lower jaw, posterior border of vertical ramus to last molar.....	290 mm.
Lower jaw, vertical diameter of ramus opposite last molar.....	170 mm.
Lower jaw, vertical diameter of ramus at first molar.....	175 mm.
Lower jaw, vertical diameter of symphysis midway between incisors and posterior border.....	125 mm.
Lower jaw, total length of lower cheek-teeth.....	285 mm.
Lower jaw, antero-posterior diameter of first cheek-tooth.....	120 mm.
Lower jaw, greatest transverse diameter of first cheek-tooth.....	70 mm.
Lower jaw, antero-posterior diameter of last molar.....	172 mm.
Lower jaw, greatest transverse diameter of last molar.....	73 mm.

VERTEBRAL COLUMN

The vertebral column is represented by the axis, the third cervical, and five dorsals from approximately the middle region. In comparing these with the corresponding parts in the American Mastodon in the Carnegie Museum the neural spine of the axis in the new species is relatively heavier; its anterior border extends more forward, showing that it must have partly protruded over the arch of the atlas; the post-zygapophyses slope more strongly upward than in *M. americanus*; the pedicles are heavier; the neural canal perhaps larger; and the centrum slightly longer than in the more recent species. The third cervical vertebra has no neural spine, while in *Mastodon americanus* there is a slight process. The centrum of this vertebra is little if any longer than in *M. americanus*. From the parts present it seems clear that the neck in the present species was relatively longer than in *M. americanus*.

The dorsal vertebræ lack the neural spines, which have been broken off, but their bases indicate the characteristic backward slope of the spines in the Proboscidea. The neural canal is of large size and the general features of the column in this region, as preserved in the type, are not unlike those of "*Eubelodon morrilli*" illustrated by Professor Barbour (Univ. Studies, April 1914, Vol. XIV, plate XI).

RIBS

The ribs are represented by many fragments, some with the articulating heads and shafts more or less complete. The third rib of the right side is practically complete. This rib is very nearly equal in length to the corresponding rib in *M. americanus*, though slenderer, indicating a thoracic cavity of large size, as in the case in the Nebraskan species.

MEASUREMENTS

Axis, greatest height approximately.....	257 mm.
Axis, transverse diameter at post-zygapophyses.....	135 mm.
Axis, transverse diameter at anterior cotylæ.....	185 mm.
Axis, antero-posterior diameter of centrum approximately; measurement taken of posterior face.....	150 mm.
Axis, greatest transverse diameter of neural canal.....	67 mm.
Axis, greatest vertical diameter of neural canal.....	72 mm.
Third cervical vertebra, greatest vertical diameter.....	215 mm.
Third cervical vertebra, greatest vertical diameter of centrum; measurement taken of posterior face.....	128 mm.
Third cervical vertebra, transverse diameter at post-zygapophyses.....	164 mm.
Dorsal vertebra, near the lumbar series, vertical diameter of centrum, posterior face.....	100 mm.
Transverse diameter of same.....	110 mm.
Third rib, length measured along the curve.....	865 mm.

LIMBS

Scapula. The coracoid portion of the scapula is not nearly as heavy as in *M. americanus*; the lower part of the spine is near the articulating surface for the humerus as in *M. americanus*.

Humerus. The humerus is represented by the median portion of the right shaft and many fragments. The deltoid ridge extends well down and the shaft suddenly flares, indicating similar though shorter proportions than found in *M. americanus*.

Radius and Ulna. The epiphyses of the radius and ulna are not completely coossified with the shaft.

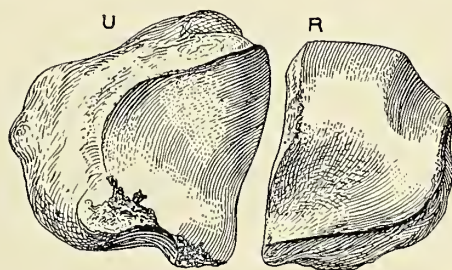


Fig. 21. *Serridentinus fricki* Peterson, sp. nov. Views of distal ends of radius and ulna of the right side. (Type). (C. M. Cat. Vert. Foss., No. 11,379), one-fourth natural size.

Carpus. Except the prominent ridge, which separates the facets for the scaphoid and lunar, and the relatively small size of the latter facet, these parts do not show any unusual characters, by which they may be said to differ from corresponding parts in *M. americanus*. The unciform is more deeply excavated on the radial and dorsal faces than in *M. americanus*, and a tubercle of large size rises from the proximal articular surface at the dorso-ulnar angle, which does not appear in the Pleistocene form. The articular surfaces for metacarpals III, IV, and V are dis-

tinctly marked and there is a rugose palmar tuberosity similar to that in *M. americanus*.

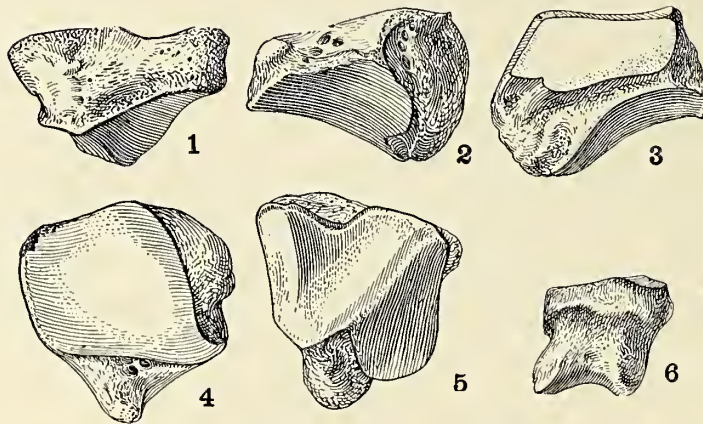


Fig. 22. *Serridentinus fricki* Peterson, sp. nov. 1-5 Ulniform of type (C. M. Cat. Vert. Foss., No. 11,379). 1, Oblique dorsal view; 2, Ulnar view; 3, Radial view; 4, Proximal view; 5, Distal view; 6, Dorsal view of phalanx of fifth (?) digit. All figures one-fourth natural size.

Phalanges. An asymmetrical phalanx, perhaps of the fifth digit, is all that is preserved of the toes.

Fragments of the femur and both tibiae are preserved.

All the parts found pertain, without doubt, to one individual, as there are no duplicates nor disproportions in the different parts which are preserved.

MEASUREMENTS

Scapula, greatest antero-posterior diameter of glenoid cavity.....	174 mm.
Scapula, greatest transverse diameter of glenoid cavity.....	95 mm.
Ulniform, greatest transverse diameter.....	112 mm.
Ulniform, greatest antero-posterior diameter.....	110 mm.
Ulniform, greatest vertical diameter (dorsal face).....	55 mm.
Ulniform, greatest vertical diameter (palmar face).....	78 mm.
Phalanx, greatest length.....	55 mm.
Tibia, greatest antero-posterior diameter.....	115 mm.
Tibia, greatest transverse diameter.....	162 mm.

A YOUNG SPECIMEN OF SERRIDENTINUS FRICKI (?).

(Plate XIV)

Approximately three hundred meters from where the type of *Serridentinus fricki* was found and in a slightly higher horizon there was found during the season of 1926 a second specimen, a disarticulated skull of a young individual. The best preserved parts of this specimen are the right and left maxillae with the teeth. The high temporal fossa, the delicate malar portion of the zygomatic arch and the position of the infraorbital foramen are like those in the adult specimen described

above and may well belong to the same species. The superior border of the facial region is sufficiently preserved to give the complete vertical diameter of this region of the skull. Between the narial-premaxillary trough, for the proboscis, and the temporal fossa there is a rather narrow margin, but the actual size of the trough for the proboscis cannot be ascertained, because of the incompleteness of the specimen. In this young specimen no parts of the tusks or incisors are present. The first cheek-tooth has two fangs; its crown being triangular in outline. There are four low tubercles, irregularly placed, the external anterior being the largest, the postero-external next in size, an antero-internal ridge-like cingulum, and an intermediate cingular cusp. The shape and position of this tooth suggests that of the second cheek-tooth in *Trilophodon angustidens*,⁴⁴ but in the latter the tubercles are differently arranged. In *T. angustidens* the alveolar border is also longer and there are more cheek-teeth simultaneously erupted than in the American species under study. The second cheek-tooth in the present specimen has three cross-ridges, the anterior much worn, but indicating the usual large internal and small external tubercles. The second cross-ridge is better outlined, but no detailed structure of the two main tubercular bodies is shown. The third cross-ridge has three tubercles; an irregularly shaped and larger internal, an oblong intermediate, and a more nearly conical external; the three more or less closely united to form one body or cross-crest. (See Pl. XIV, fig. 2 and 3). Back of the last complete cross-crest there is a heavy cingulum, or rather a spur-like element, which has its origin at the posterior inner angle of the internal tubercle of the last cross-crest, not unlike what may be observed in the tooth of the maxilla of a young "*M. floridanus*" figured by Lucas,⁴⁵ and recently used as the type of a new species by Frick (*l. c.*, p. 169, figs. 20A-C. p. 140). Back of this spur there is a basal cingulum, which continues from the inner angle half-way across the base of the crown. The only wear on the succeeding and recently erupted cheek-tooth is on the anterior intermediate tubercle. The anterior cross-crest consists of two closely connected tubercular bodies, an internal and an external. The second cross-crest is also composed of two main cones with smaller cone-like bodies closely adhering. The individual bodies of the third cross-crest are less distinct from one another, so that the wear of this crest would show less separation of the internal and external bodies. Posterior to the third cross-crest is a double cingulum, the anterior of which may be regarded as an incomplete fourth cross-crest, (See Pl. XIV, figs. 2 and 3).

The most noteworthy feature of this young specimen is the presence of the germ

⁴⁴Paleontographica Vol. XVII, 1867, Pl. III, fig. 1.

⁴⁵Trans. Wag. Inst., Vol. IV, 1896, Pl. IV, fig. 10.

for the fourth? cheek-tooth. This tooth was found after extensive excavation of the maxilla immediately above the milk molar in position as figured, (See Pl. XIV, fig. 1). The calcification is sufficiently advanced to give a general description, but the internal face and a portion of the posterior face are disintegrated and lost. On the antero-external portion of the crown is a prominent cone-shaped tubercle, which is separated from the cross-crest back of it by a deep, narrow, cross-valley. The posterior cross-crest is represented only by the external portion, which is only about half the diameters of that of the anterior tubercle just described. Posteriorly there is a low, but prominent cingulum, (Pl. XIV, figs. 4, 5).

MEASUREMENTS

Dentition: total length.....	194 mm.
First cheek-tooth: antero-posterior diameter.....	24 mm.
First cheek-tooth: transverse diameter.....	21 mm.
Second cheek-tooth: antero-posterior diameter.....	79 mm.
Second cheek-tooth: transverse diameter at posterior cross-crest.....	49 mm.
Third cheek-tooth: antero-posterior diameter.....	104 mm.
Third cheek-tooth: transverse diameter.....	60 mm.
Fourth cheek-tooth: buried in the maxilla, Antero-posterior diameter of the fragment.....	42 mm.

A RESTORATION OF SERRIDENTINUS FRICKI

(Plate XV)

The preservation of the different parts of the skeleton which have been described led to an attempt to make a restoration of the form of the animal in life. A sketch was admirably executed by Director A. Avinoff (See Plate XV). The long head and neck, and the short limbs, show us an animal probably capable of reaching the ground with its lower incisor tusks. The creature was relatively heavier in body than the American Mastodon and the elephant of today, and no doubt was surrounded by entirely different conditions from those which prevailed in Pleistocene times and which now prevail.

Parelephas washingtoni Osborn.

In the Pleistocene formation on Lay Creek, Moffat County, Colorado, about one half mile from Lay Post Office, Mr. M. A. Langley found a left lower molar of a Proboscidean, which was later presented to the Denver Museum of Natural History by Mr. A. G. Wallihan of Lay, Colorado. Upon comparison this lower molar (No. 472, Denver Museum Catalogue) compares very closely with *Parelephas washingtoni* Osborn. The posterior portion of the tooth is broken, but there are sixteen cross-crests present and there were probably from three to five ad-

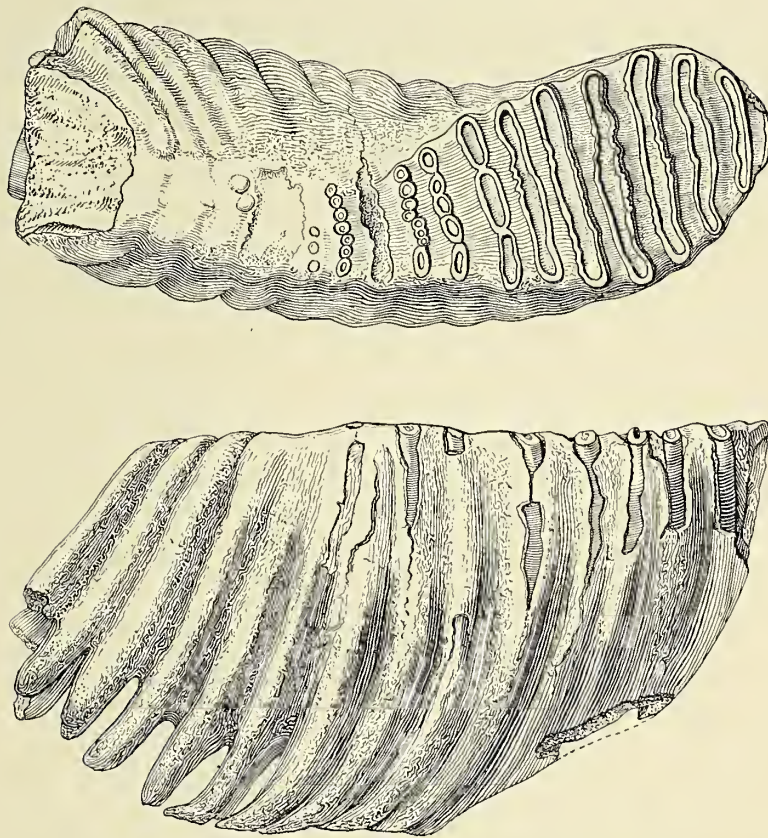


Fig. 23. *Parelephas washingtoni* Osborn. Crown and lateral views of lower left molar, (No. 472, Denver Museum Catalogue). One-fourth natural size.

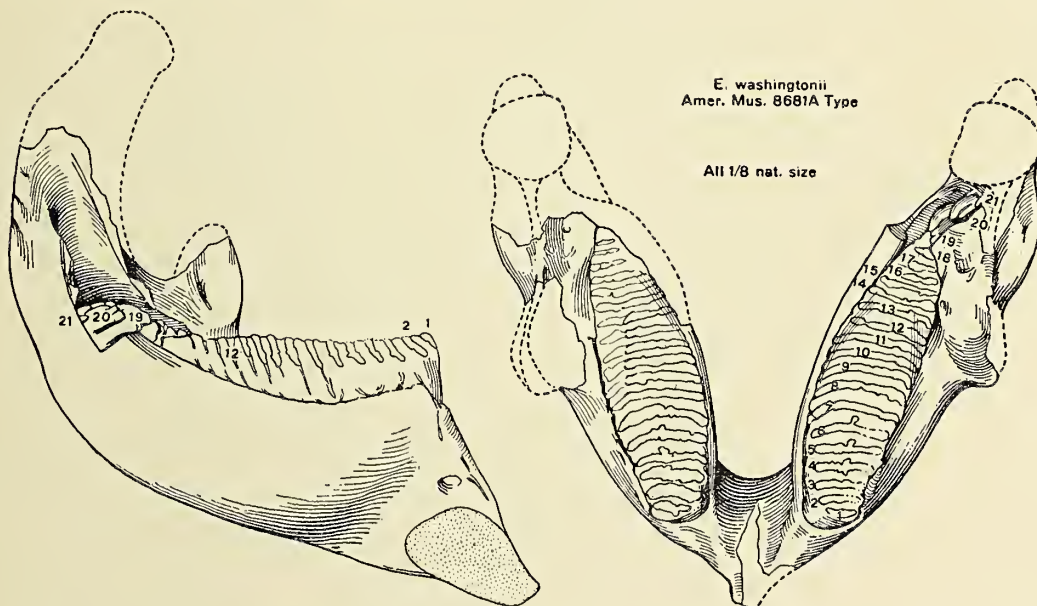


Fig. 24. Crown and lateral views of lower molars of type specimen of *P. washingtoni* loaned by Professor Osborn for comparison with tooth from Pleistocene of Brown's Park, Colorado, shown in fig. 23.

ditional crests in the complete tooth. The size of the tooth, the number of the cross-crests as well as their thickness and degree of crenulation is quite closely identical with the type in the American Museum of Natural History, of which an illustration is herewith published through the courtesy of Professor Henry Fairfield Osborn, President of the American Museum of Natural History, New York.

SUPPLEMENTARY NOTE.

Professor Henry F. Osborn in a letter to me, dated May 9, 1928, expresses the opinion that the proboscidean, which I have described on p. 111, is *Trilophodon*, and not *Serridentinus*. Osborn regards my proposed species as valid and as being extremely primitive. In a second letter, received June 5, 1928, Osborn suggested that I publish a note changing both the generic and specific names of the specimen in the Carnegie Museum, because it is pre-occupied by Barbour's species *Trilophodon (Amebelodon) fricki*. Osborn repeats his opinion that the specimen in the Carnegie Museum is a good species, representing a very primitive type, between the Middle and Upper Miocene.

Dr. O. P. Hay, writing from the U. S. National Museum, Washington, D. C., under date of May 23, 1928, says that it is his opinion that my *Serridentinus fricki* should be assigned to the genus *Gomphotherium*. For the specimen in the Carnegie Museum Hay proposes the specific name *petersoni*, inasmuch as Professor Barbour of Nebraska has already used the name *fricki* in his description of *Amebelodon fricki*, which Hay puts into the genus *Gomphotherium*.

In a letter dated May the fifteenth 1928, Dr. Julian D. Sears of the United States Geological Survey, states that he is of the opinion that I have misunderstood and therefore misinterpreted (in my notes, pp. 94-96 in the foregoing article) Schultz's reference to the "Bishop conglomerate," in his publication, Bull. 690-C, United States Geological Survey. Not having had an opportunity to visit the regions spoken of in order to verify Schultz, I took it for granted from his remarks on various pages¹, that, if he had found the soft reddish colored tertiary beds and the "Bishop conglomerate" beds together along the southern flanks of the Uinta mountains, the conglomerate was always found at the base. Since receiving Sears' letter I now add:

From the information we have gained by the discovery of the small and fragmentary fauna (described on previous pages, p. 99, p. 110-111) from the uppermost beds of the sediments in the Uinta basin, I still feel inclined to regard these beds as of Brown's Park age. If the "Bishop conglomerate" beds are found to rest on these Tertiary beds south of the Uinta range, not only have I misunderstood Schultz, but entirely misunderstood the geological age of the so-called "Bishop conglomerate."

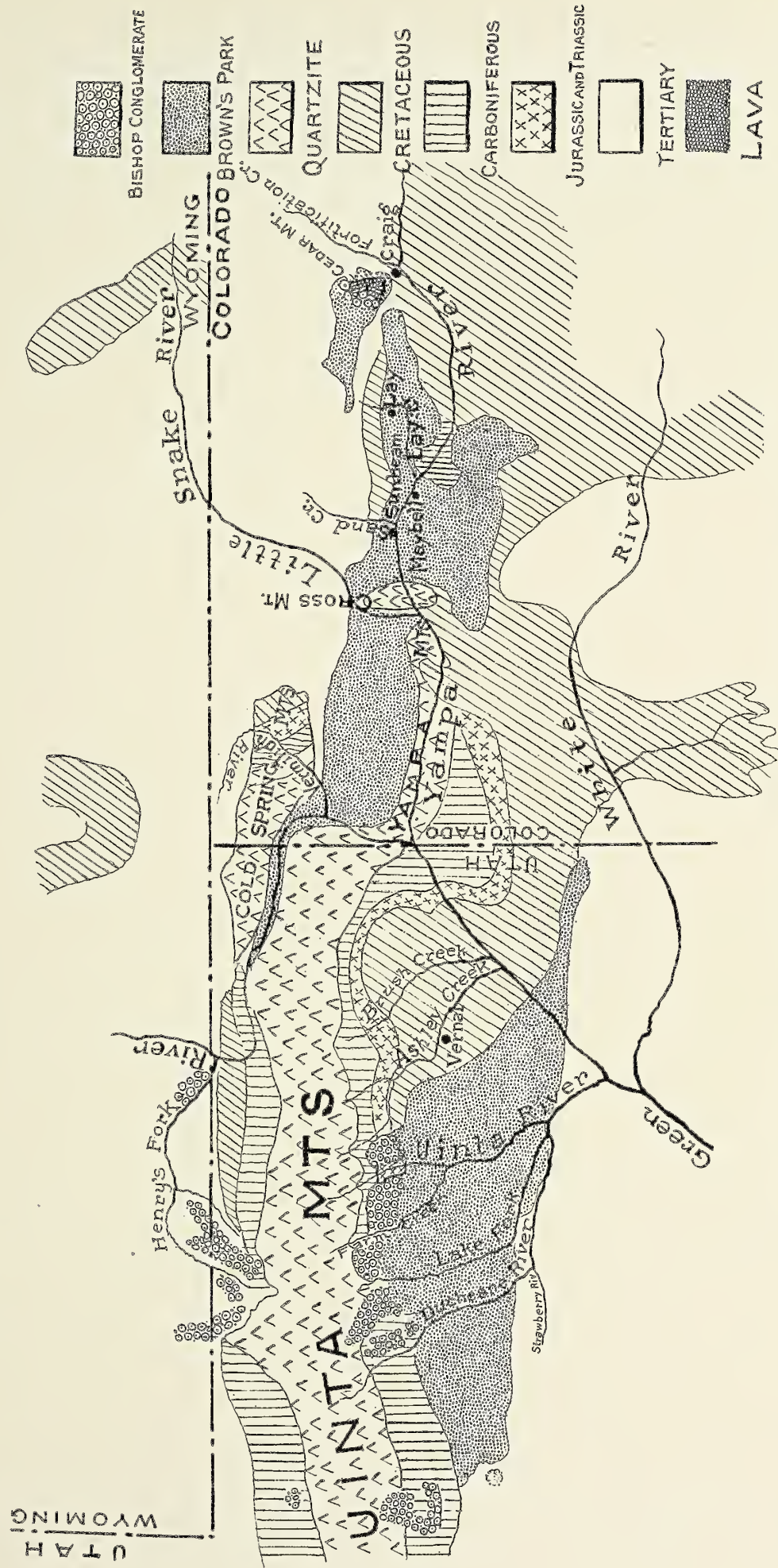
¹Schultz, Bull. U. S. Geol. Surv., 690-C:

p. 56, "The older strata are covered deeply by rocks of Tertiary and later age."

p. 67, "The fault . . . passes beneath the Bishop conglomerate that forms the flat table and of the mountain."

p. 86, "The outcrop of the phosphate bed at the upper margin of the dip slope is also concealed in many places by the Bishop conglomerate . . . A short distance east of the White Rock River, the phosphate beds are concealed by the Bishop conglomerate and Tertiary sediments which cover most of the area on Mosby and Lake Mountains."

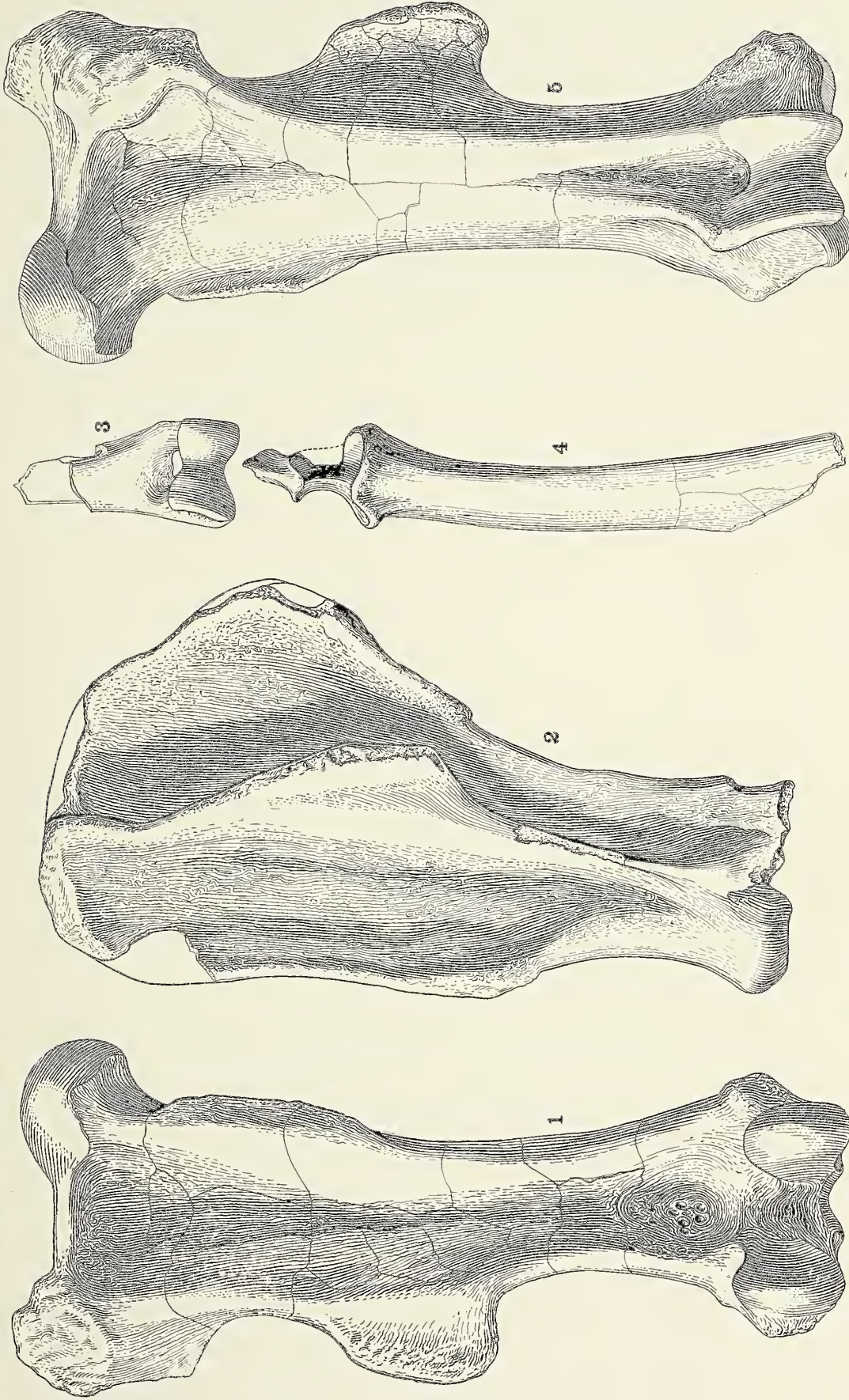
p. 87, "In the divide between Dry Fork and Ashley Creek, the outcrop of the phosphate bed is in part concealed by the Bishop conglomerate."



Map showing the location of the Brown's Park beds in northeastern Utah and northwestern Colorado. This map is based upon the map prepared by the United States Geological Survey in 1911 under the supervision of Messrs. Bailey Willis and George W. Stose.

EXPLANATION OF PLATE X

- Fig. 1. *Aphalops ceratorhinus* Douglass. Posterior view of femur, No. 11,387. One-fourth natural size.
- Fig. 2. *A. ceratorhinus* Douglass. External view of scapula, No. 11,387. One-fourth natural size.
- Fig. 3. Cameloid. gen.? sp.? Anterior view of humerus.
- Fig. 4. Do. Radius and ulna, No. 11,388. One-third natural size.
- Fig. 5. *A. ceratorhinus* Douglass. Anterior view of femur No. 11,387. One-fourth natural size.



For explanation see opposite page.

EXPLANATION OF PLATE XI

Serridentinus fricki, sp. nov. (Type). C. M. Cat. Vert Foss. No. 11,379. All figures one-sixth natural size.

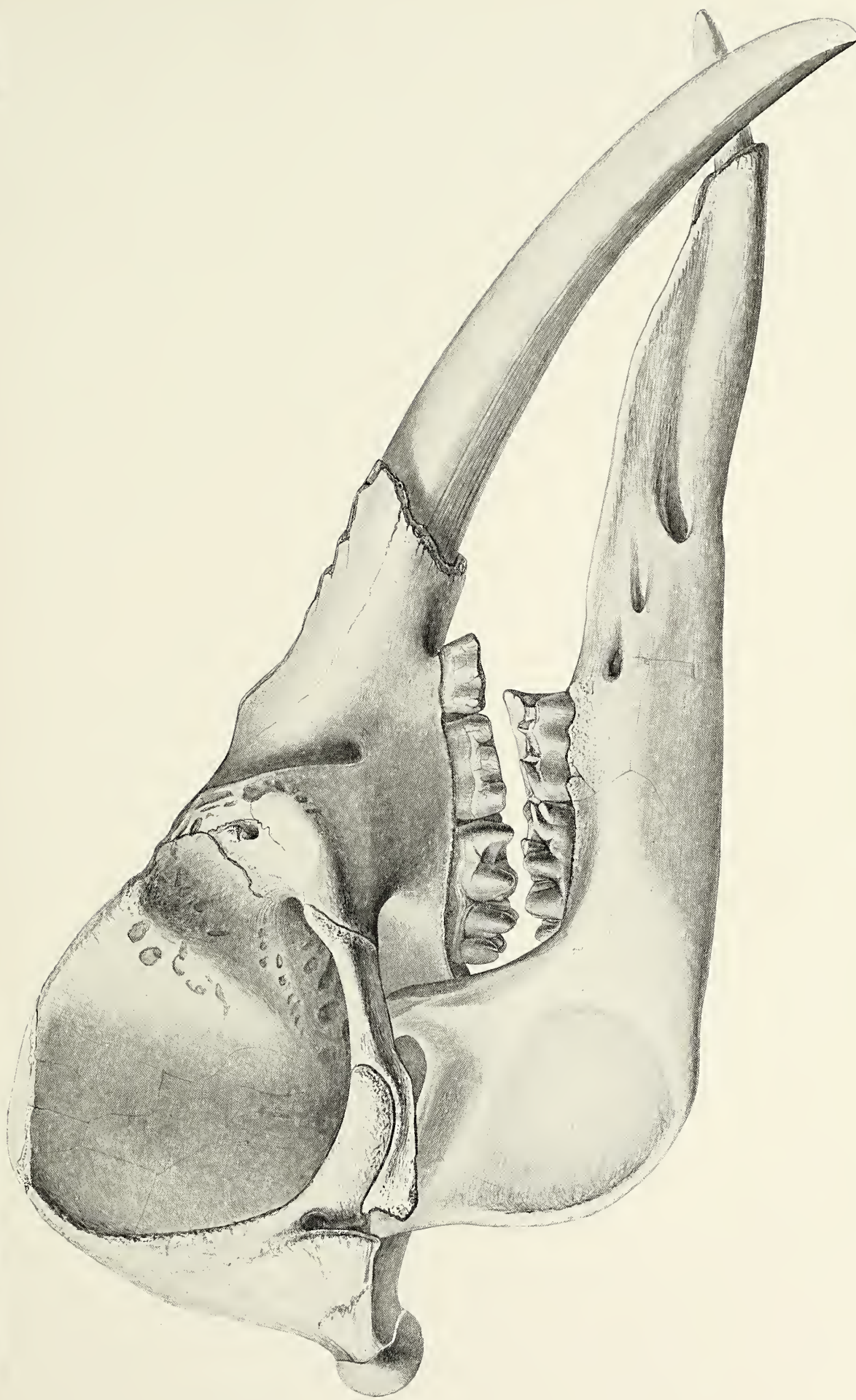
- Fig. 1. External view of rib.
- Fig. 2. Side view of dorsal vertebræ.
- Fig. 3. Anterior view of right tibia.
- Fig. 4. Distal view of right tibia.
- Fig. 5. Side view of axis.
- Fig. 6. Anterior view of humerus.
- Fig. 7. External view of scapula.
- Fig. 8. Anterior view of left tibia.



For explanation see opposite page.

EXPLANATION OF PLATE XII

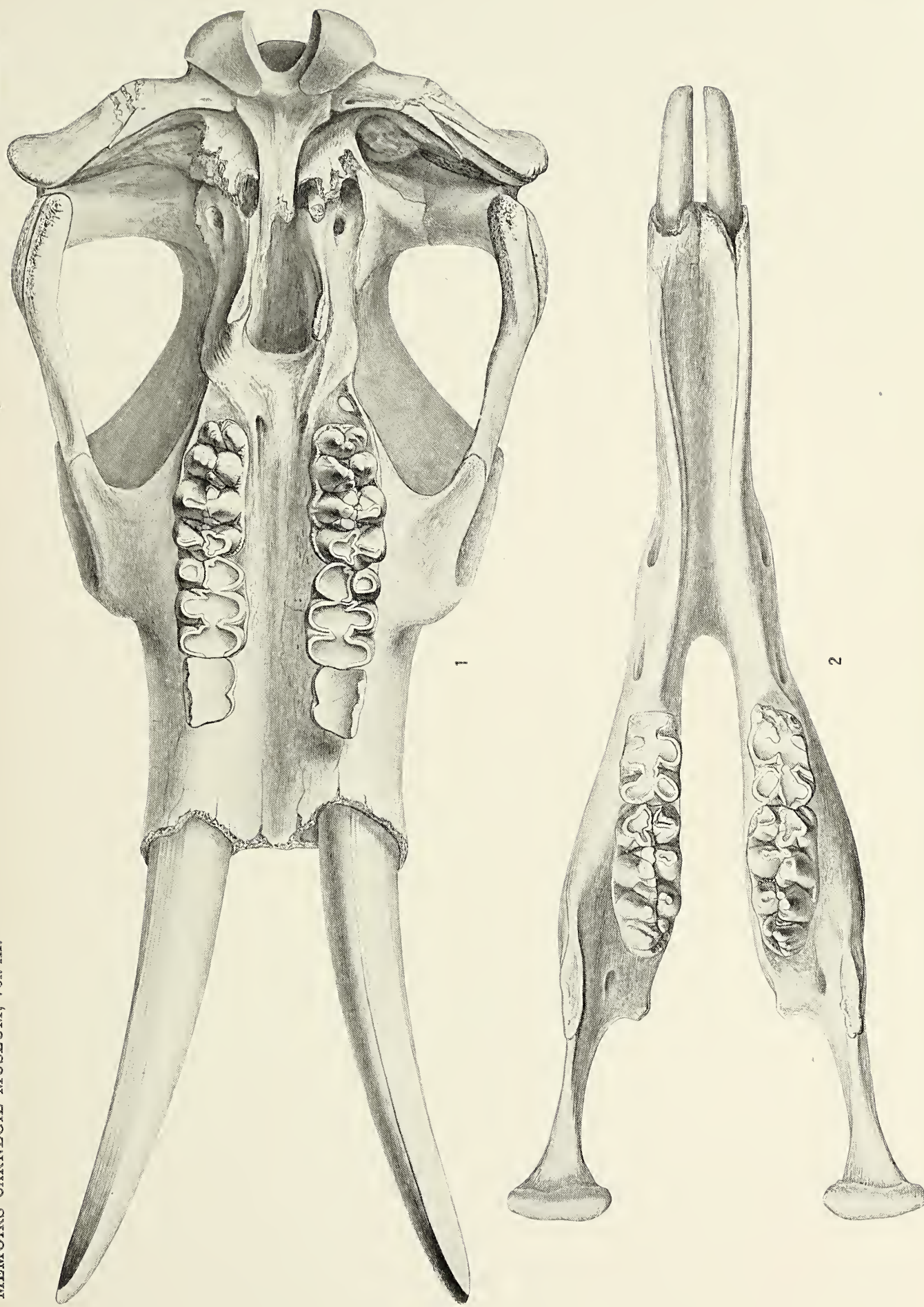
Skull and jaws of *Serridentinus fricki*, sp. nov. (Type). C. M. Cat. Vert. Foss. No. 11,379,
one-sixth natural size.



For explanation see opposite page.

EXPLANATION OF PLATE XIII

- Fig. 1. Ventral view of cranium of *Serridentinus fricki*. (Type). C. M. Cat. Vert. Foss. No. 11,379, one-sixth natural size.
- Fig. 2. Dorsal view of lower jaw of *Serridentinus fricki*, sp. nov. (Type). C. M. Cat. Vert. Foss. No. 11,379, one-sixth natural size.

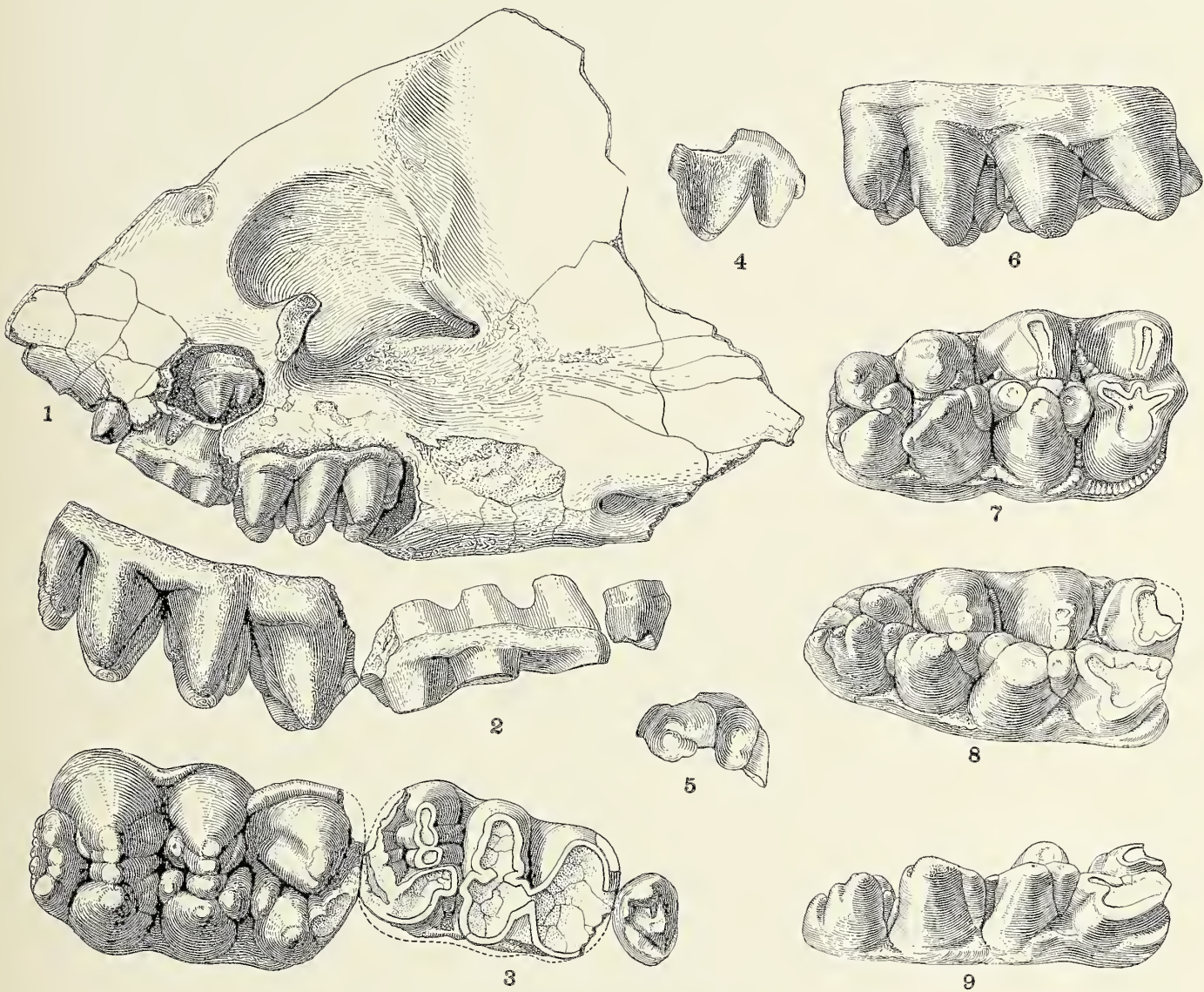


For explanation see opposite page.

EXPLANATION OF PLATE XIV

Serridentinus fricki Peterson, sp. nov.

- Fig. 1. Left side of facial region of skull of young animal, No. 11,389, one-fourth natural size.
- Fig. 2. External face of cheek-teeth of young skull, No. 11,389, one-half natural size.
- Fig. 3. Crown view of upper teeth of the same specimen shown by figs. 1 and 2, one-half natural size.
- Fig. 4. External view of unerupted cheek-tooth in skull of young animal, No. 11,389.
- Fig. 5. Crown view of the tooth shown in fig. 4.
- Fig. 6. External view of the last upper molar of the type specimen, No. 11,379, one-third natural size.
- Fig. 7. Crown view of the tooth shown in fig. 6, one-third natural size.
- Fig. 8. Crown view of last lower molar, type specimen No. 11,379, one-third natural size.
- Fig. 9. External view of the tooth shown in fig. 8, one-third natural size.



For explanation see opposite page.



Restoration of *Serridentinus fricki* Peterson. Drawn by Andrey Avinoff, Sc.D.